Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LII. NEW YORK, SATURDAY, OCTOBER 17, 1908. No. 16.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. MCGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.

239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....4.50
Other Foreign Countries within the Postal Union.....6.00
25 shillings 25 marks 31 francs
Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Copyright, 1908, by MCGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of ELECTRICAL WORLD *for 1908 to date has been 732,500 copies. Of this issue 15,000 copies are printed.*

NEW YORK, SATURDAY, OCTOBER 17, 1908.

CONTENTS.

Editorial 831
Convention of the American Street and Interurban Railway Association 834
Empire State Gas and Electric Association 834
Economic Power Company Defies Public Service Commission 835
High-Potential Underground Transmission 836
Lead-Covered Cables Injured by Insects 837
Improvements at the Massachusetts Institute of Technology 837
New Method of Resuscitation from Apparent Death 837
Historical Books at the Electrical Show. By Brother Potamian 838
Convention of Western Association of Electrical Inspectors 839
Regulation of Electric Services by Commissions 839
Brooklyn Section of N. E. L. A. 839
Novel Turbine Installation for New York Subway 840
A Belated Nernst Patent 840
Current News and Notes 840
Wiring and Lighting Equipment of the Stack Room of the New York Public Library. By J. F. Musselman, Jr 841
The Effect of Wave Form Upon the Voltage Ratio of Transformers. By Morton G. Lloyd 845
The Telephone Repeater. By L. A. Lindsey 846
Improving Power Factor by Means of Synchronous Motors 847
Experience in Steam Turbine Operation 848
Discussions of Papers at the I. E. S. Convention 848
Power Engineering by Central Stations. By H. W. Hillman 852
Central Station Exhibits at the Electrical Show 853
Wiring and Equipping a Large Commercial Building. By J. S. Webster 855
New Telephone Patents 856
LETTERS TO THE EDITORS.
Tungsten Lamps vs. Gas Mantles. By W. W. Cummings 857
Efficiences of Nernst Lamps. By J. R. Cravath and V. R. Lansingh 857
Digest of Current Electrical Literature 858
Exhibits at the Atlantic City Railway Convention 862
Battery-Charging Rheostat 865
New Holophane Reflectors for Tungsten Lamps 866
Insulator Wall Bracket 866
Electric Curling Iron 866
Combined Washing Machine and Wringer 867
New Electric Pyrometer 867
Industrial and Commercial News 868
General News 872
Weekly Record of Electrical Patents 879

THE TELEPHONE REPEATER.

An article by Mr. L. A. Lindsey on page 846 of this issue adds another to the many suggested solutions to the problem of constructing a satisfactory telephone repeater. Having outlined the disadvantages in repeaters of the mechanical-motion type and finding excessive mass to be one of the impediments, he suggests that the moving part be constructed of aluminum wire. While a change of the character mentioned by Mr. Lindsey might result in some improvement, it can hardly be considered as sufficient to render the repeater a satisfactory device. The assumption by the author that in the construction of a telephone repeater it is necessary to follow the plan of converting the minute electrical energy into the energy of mechanical motion, is open to some doubt. It is certainly conceivable that the received current could be passed, say transversely, through some substance as yet undiscovered or unidentified, whose longitudinal resistance would be varied enormously by a small change in the transverse current. A properly-shaped mass of such a substance could be inserted in series with a battery of appropriate voltage to form a self-continued telephone repeater. Moreover, it is not impossible that there will be found a substance whose electrical resistance varies greatly with any small change in the magnetic field in which it may be placed. A substance of this nature substituted for the diaphragm of a telephone receiver would furnish an excellent resistor device for the telephone relay circuit. It is far more likely that the telephone repeater of the future will be based on the advantageous electrical or magnetic properties of some substance not yet discovered than upon improvements of a mechanical nature. A systematic study of all substances exhibiting eccentric behavior under the action of electric or magnetic fields offers sufficient promise of results of benefit to mankind to justify the serious attention of physicists.

THE EFFECT OF WAVE FORM UPON THE VOLTAGE RATIO OF TRANSFORMERS.

It is well known that the wave shape of e.m.f. impressed upon a transformer has an effect upon the hysteretic loss in its core, and that flat waves increase this loss, while peaked waves reduce it. The effect, however, of wave-form upon the regulation of a transformer has not received attention. The subject is treated in the article by Mr. Morton G. Lloyd, appearing on page 845 this week. The definition employed in this article for the term "voltage-ratio" or "transformation-ratio," as applied to a transformer, is perfectly proper in itself, but is not consistent with the general system of definitions employed by the American Institute of Electrical Engineers. According to that system, the ratio of transformation, when applied to the primary or received quantity, gives the secondary or delivered quantity. A step-down transformer should, therefore, have a ratio of transformation less than unity. At rated non-inductive load, the ratio would then be that of secondary terminal volts to primary terminal volts. At no-load it would be, for all practi-

cal purposes with commercial shunt transformers, equal to the ratio of secondary turns to primary turns. The article points out that, from experimental observations, there is a small change in the ratio of a transformer depending on the wave-shape of the impressed e.m.f. on the load, and on the power factor of the load. For engineering purposes, this wave-form effect on the ratio appears to be negligible; but the article is useful as showing that the definition of ratio ought, strictly speaking, to involve reference to the sinusoidal wave-form as the standard. It is well known that so far as concerns the voltage regulation, a transformer may be regarded as the equivalent of a simple choking coil inserted in a simple main circuit, together with a numerical change of voltage and current beyond the coil. This assumes the leakage current, or exciting current, to be negligible in its influence on the regulation. From this standpoint, we can study the effect of change in wave-form of impressed primary e.m.f. on the regulation of a transformer by studying the voltage drop in a choking coil, when the wave-shape of the impressed e.m.f. is varied, and when the load and power factor of the load are varied in the circuit of the coil. All of the reasoning set forth in the article appears to apply to this analogy, which is easier to think about than the two circuits of a transformer.

The Measurement of Large Ferric Inductances with Feeble Currents.

It is well known that when a choking coil is non-ferric, that is, has no iron or magnetic metal in its magnetic circuit, its inductance is substantially the same through a wide range of frequencies and current strengths; but that as soon as we insert iron into the magnetic circuit of the coil, so as to have a ferric inductance, the measurement is much harder to make. The inductance varies in that case with the frequency and also with the magnetizing current. An interesting communication on the measurement of ferric inductances, by Messrs. Oliver Lodge and Benjamin Davies, appears in the *Journal* of the Institution of Electrical Engineers of London for August, 1908. The method employed is that of substitution. A small sinusoidal alternator of suitable frequency is connected in series with the coil whose reactance is to be measured, and a particular type of aperiodic D'Arsonval galvanometer. A certain oscillation amplitude of deflection is obtained. The reactance is then replaced by a non-inductive known resistance which is adjusted until the same oscillation amplitude is secured. The impedance of the ferric coil is then known to be equal to the adjusted resistance, from which equality the reactance can easily be evaluated. An ingenious device for securing aperiodicity in the galvanometer is to wind the galvanometer coil upon an aluminum frame, and to vary the intensity of the electromagnetic field in which the coil swings until the throw of the reflected image on the scale just does not overshoot the full deflection from the current of a voltaic cell through non-inductive resistance. This is the same kind of adjustment as is required for an oscillograph in its best condition of operation. In the oscillograph, the damping force is adjusted by changing the viscosity of the oil. In this aperiodic oscillation galvanometer, it is secured by varying the magnetic viscosity of the field.

The measurements made with the apparatus upon a large ferric inductor, adjustable between 16 henrys and 120 henrys by varying the air-gap, showed that the inductance was nearly independent of the frequency up to frequencies of 15 cycles per second. Moreover, the inductance was nearly independent of the magnetizing force up to about 1-30 of a gilbert per centimeter. The permeability of the laminated iron core used was 228 within this range. The same order of magnitudes might be expected in the case of a transformer for low frequencies of magnetization. For many telegraphic purposes the values of inductance in their receiving apparatus is of importance. It is very interesting to find a particular form of vibration galvanometer operating so conveniently at low frequencies.

Studies in Natural Illumination.

One of the striking papers at the I. E. S. Convention was Mr. Leonard J. Lewinson's investigation of the intensity of sunlight and moonlight in terms of ordinary standards. The actual title of the paper gives, perhaps, too broad a view of its scope and might lead one to look for data which were not included in the research. The problem to which Mr. Lewinson addressed himself was to follow up the cycle of the day, and, by pointing his photometer directly at sun and moon or at diffusing surfaces in their direct rays, to draw up a curve of sunlight and moonlight intensities. There has been a lack of data on this subject which Mr. Lewinson's work will supply. Certain phases of the subject have been exhaustively studied by astronomers, especially the relative intensities of sun and moon and the corrections to be applied to these figures by reason of varying attitude. The results thus obtained have a precision which perhaps can hardly be approached by any short series of tests with commercial instruments, yet they do not give quite what the ordinary man wants to know—that is, the practical intensity of daylight and nightlight in an every-day city under every-day conditions. This latter information is precisely what Mr. Lewinson's paper supplies. The figures, as might be expected in city observations, are not concordant, but this irregularity is one of the very things which must be taken into account.

The value found for sunlight range from about 12,000 foot-candles downward, and those for moonlight from 0.02 or 0.03 downward. The moonlight values wander quite erratically, owing, doubtless, to the difficulty of measurements of low intensities with large color differences. Slight variations of the sky conditions also enter into all such determinations and are hard to eliminate. Taking the ratio between the largest sunlight value observed and the largest moonlight value, makes the ratio of moon to sun in light-giving power 1 : 424,000, as compared with 1 : 618,000 by Zollner, 1 : 470,980 by Bond, and 1 : 540,000 by Pickering. As Mr. Lewinson's maximum moonlight reading looks abnormally large for this latitude, the ratio is probably in really very good accord. Taking instead of the maxima, his judgment of the data in his summary, the ratio is .014 to 8000, i.e., 1 : 571,000, which shows the good work that commercial photometers can be made to do in competent hands. The uncertainty in all these measures lies probably in the great color differences, which cannot wholly be eliminated. One of the curious observations that strikes the reader in Mr. Lewinson's paper is his note of the difficulty of reading when twilight falls to, say, 2 foot-candles, in spite of the ease of reading with that amount of artificial light. The effect appears to have been due to subjective causes, since reading by 2 foot-candles of diffused daylight in a room is certainly fairly easy.

Here is another fact, then, to point the value of diffusion and of freedom from the intrusion of bright sources.

The sudden changes of brilliancy at and near sunset and sunrise are most striking. It is most startling to realize that the light of the sun when close down to the horizon is really cut down to a very few per cent of its noonday value. The color difference, too, is something extraordinary. Could one work at noon under a light of the color of the sun on the horizon, the effect would be most startling. Something of its character may be realized in changing from fading sunlight to an electric arc. Fortunately the change in color from noon to sunset is so very gradual that it fails to distract the attention. As to moonlight, its intensity is so small that physiological factors are dominant in the result, and the moon in rising looks far less red than the setting sun. Mr. Lewinson's figures show very clearly that moonlight has so low an intensity that it is not worth much for purposes of illumination. The "moonlight schedule," so far as it depends upon moonlight, is a pretty poor apology for lighting. The chief good points about moonlight are that it is steady, from a source of moderate intrinsic brilliancy, and comes from a direction that gives it excellent diffusion. The natural light which one commonly utilizes is diffused sunlight and skylight of various sorts greatly modified in intensity and in color. If the direct sunlight intrudes, one generally squints and draws the curtains. Attempts to work in direct sunlight would, in fact, be very hazardous to the eye, being far beyond its proper range of action. As to sunlight, in short one must regard it as raw material, while moonlight, though finished, is inadequate. About four moons like the existing one are needed for real business.

Experiments on Reflections of Light from Ceilings and Walls.

Among the papers presented at the recent convention in Philadelphia of the Illuminating Engineering Society is one by Messrs. Lansingh and Rolph upon some experiments on reflections from ceiling, walls and floor, and which adduces experimental results of great interest. At night, excluding the feeble luminous effects of moonlight, the illumination of our books, desks, tables and general surroundings, is jointly obtained from direct and indirect light, emitted by our artificial sources, be they candles, gas jets, oil lamps, incandescents or arcs. The direct light is the light radiated directly from each and all of the lamps. The indirect light is that which does not proceed directly from any lamp, but which comes reflected and scattered from walls, ceilings and surrounding objects. If we employ black tables, walls, floors and ceilings, as in the lugubrious, but business-like furnishing of a photometer room, the illumination at any surface is practically all direct, the scattered and reflected light being very feeble. If, on the contrary, we employ bright white ceilings, whitewashed walls, white tiled flooring, and only a little furniture, with that little white or light colored, we may expect a relatively large amount of indirect light. The important practical question comes before the illuminating engineer—given a certain size of room, with given color values of walls, floor, ceiling and furniture, what will be the amount of indirect illumination, and what will be its effect upon the number and distribution of the lamps required, in order to produce a given intensity of average illumination? This is a question for which it is very difficult to find a correct answer by direct computation, because of the great complexity of conditions entering into the results. Even if the reflecting properties of all the active surfaces were correctly obtainable, not only of the ceiling, but also of the wall paper, curtains, pictures, furniture, carpets, etc., the problem would be indeterminable of solution, owing to its intricacy. Nevertheless, the engineer is required to find a practically satisfactory solution of the problem, and if this solution is unobtainable directly, it must be found by approximate and indirect method. Empirical formulas are available employing constants that previous experience under similar conditions has shown to be reliable.

In the case described in the paper, a windowless room about 24 ft. x 12 ft., and 10 ft. high, which would be a small room in a country house, but a fairly large room in a city flat, was subjected to a long series of illumination measurements under four different conditions of tungsten lamp arrangements, and under eight different conditions of wall, floor and ceiling reflective arrangements. These conditions varied between one extreme of bright walls, floor and ceiling, by the application of ordinary cream-colored wrapping paper, and the opposite extreme of walls, floor and ceiling dark. The results deduced in the paper show that when using bare tungsten lamps in the ceiling, the average indirect illumination near the floor, with walls, floor and ceiling bright, was nearly three times the direct illumination. The bright ceiling contributed to this indirect illumination about one-third, so that the indirect illumination from the bright ceiling was about equal in average intensity to that produced by the direct illumination from the lamp or lamps. The walls, when bright, contributed somewhat less than the ceiling; but when both walls and ceiling were bright, they mutually aided each other, and the addition due to this interaction was not far from the share of the walls alone. A bright floor was of much less effect than bright walls. Nevertheless, the interaction of a bright floor with bright walls and ceiling, added a material share. Consequently, at the ordinary table height above the floor, the effect of bright walls, floor and ceiling was about the same as quadrupling the number of ceiling lamps. Expressing the same result in another way, about four bare lamps on the ceiling would be required to produce, with dark ceiling, walls and floor, the same average table illumination as one bare lamp on the ceiling, with bright ceiling, walls and floor.

When the ceiling lamps were provided with reflecting prismatic glass shades throwing the light downward, the indirect lighting was considerably weakened. The indirect illumination from bright ceiling, walls and floor was reduced to 1½ times the direct illumination. The total illumination at table height, with bright ceiling, walls and floor, was only 2½ times the direct illumination. This may be explained by the fact that the reflector catches much of the light which would stray off to the walls and ceiling, and throws it downward with a greater effectiveness than a bright ceiling. The conclusion from the results set out in the paper is that with any arrangement of incandescent lamps, bright walls and furniture are a source of economy to a householder. They may easily double the average illumination as compared with dark tones of walls, hangings and furniture; or, for a given illumination, they may easily halve the cost of lamps and of lighting. Suitable reflectors over ceiling lamps lessen the importance of bright walls and light-colored decoration, so that when dark tones in the decoration prevail, the importance of reflectors is increased.

Convention of the American Street and Interurban Railway Association.

The convention of the American Street & Interurban Railway Association and its affiliated bodies was held at Atlantic City, N. J., Oct. 12 to 16, inclusive. Two convention halls located on Young's Million-Dollar Pier were provided for the meetings, in addition to rooms at the Chalfonte Hotel and in the Traymore Hotel. No sessions were held on Monday morning, the time being devoted to the registration of delegates and guests and to the distribution of badges. Special arrangements were made by the association for the care of delegates. Directly back of the main entrance to the convention pier were the registration booths of the Railway Associations and of the Manufacturers' Association, the former to the right and the latter to the left of the entrance. The space directly back of the registration booths was converted into a lobby specially decorated and arranged with tables, stationery, etc., for the convenience of the delegates.

On Monday afternoon the Claim Agents' Association held its opening meeting at the Traymore Hotel. The business transacted at this meeting consisted in the reading of the annual address of the president, Mr. H. R. Goshorn, by Mr. C. B. Hardin, and in the presentation of the annual reports of the executive committee and secretary-treasurer. Owing to the absence of the president, the appointment of convention committees was laid over until Tuesday.

The convention of the Transportation & Traffic Association was opened Monday afternoon, the session being held in the Greek Temple on the convention pier. This association was formed in January of this year, its objects being to bring together general managers, superintendents, passenger, express and freight agents, advertising managers and other operating officials and employees engaged in or connected with the actual operation of street and interurban railway companies, for the interchange of ideas, consideration of operating and transportation problems, methods of promoting traffic, and all other matters incident thereto. Hon. W. Caryl Ely, who was to make the congratulatory address on the opening of the meeting, was unable to be present, and the delivery of the congratulatory address was postponed until Tuesday. After the annual address of the president, Mr. C. Loomis Allen, of Utica, N. Y., the reports of the organization meeting, executive committee and secretary-treasurer were read and adopted. Some points raised by Mr. John I. Beggs, of Milwaukee, with reference to the constitution and by-laws, were referred to a committee for consideration. There being no convention committees to appoint and no special committee to report, the actual work of the convention began with the reading of a paper entitled, "How Can a Small Road Best Promote Traffic and Increase its Revenues?" by Ernest Gonzenbach, of the Sheboygan (Wis.) Light, Power & Railway Company. In the absence of Mr. Gonzenbach, the paper was read by Mr. J. H. Pardee, of J. G. White & Company.

The paper treated of the difficulties encountered by small companies conducting their business in the face of grafting politicians, unscrupulous promoters, etc., and suggested various ways in which the revenue and traffic of small roads might be increased. These included the issuing of commutation tickets, shopping tickets, etc., at reduced rates, and the maintenance of good, clean cars and a reasonable and dependable schedule. Amusement parks, in the opinion of the author, add to the load and are not a paying investment for small companies. The author is of the opinion that even larger companies might dispense with amusement parks to their profit. He maintained that better returns were obtainable from freight traffic, and the handling of freight was suggested as a good means of increasing revenue.

Judging from the character of the discussion which followed the reading of the paper, Mr. Gonzenbach had handled a live subject well. The paper was discussed by Messrs. C. A. Sylvester, of the Lexington & Boston Street Railway; D. A. Hegarty, of Little Rock, Ark.; T. W. Passailaigue, of Charleston, S. C.; H. A. Davis, of Nashville, Tenn.; P. G. Gossler, of New York; J. D. Dozier, of Lynn, Mass.; J. H. Pardee, of New York; G. W. Parker, of Detroit, and John I. Beggs.

The report of the committee on training of employees, owing to the lateness of the hour, occasioned by the prolonged discussion on Mr. Gonzenbach's paper, was laid over for action on Tuesday morning. The convention was still in progress at the time of our going to press, and the report, and discussions of the other meetings, will be published next week.

Empire State Gas and Electric Association.

The fourth annual meeting of the Empire State Gas & Electric Association was held in the United Engineering Societies Building, New York City, Oct. 7, Mr. Frank T. Glidden, vice-president and acting president, in the chair. There was a good attendance throughout the day and a number of important questions were considered. Nearly 70 companies are in membership throughout the State, including the largest corporations in such cities as New York, Brooklyn, Rochester, Syracuse, etc., making the body thoroughly representative of all interests.

An interesting brief paper was read at the morning session by Mr. R. M. Searle, of the Rochester Railway & Light Company, on the public policy work of the association. A great deal of time was devoted during the morning to the recommendations of the committee on meter testing, and a very lively discussion was provoked by the variance in practice between the methods of the Public Service Commissions of the First and Second Districts, the up-State commission discriminating against a meter by taking its highest record, rather than an equitable average as is done in the first district. The further consideration of this subject was postponed until the afternoon session in order that time might be given to a consideration of the new constitution and by-laws, involving the vital question of affiliation with national bodies. The report of the special committee dealing with this matter virtually recommended the creation of a new body in the State to include the electric light companies, which would be the State organization affiliated with the National Electric Light Association, under the new Doherty scheme which has already been applied in Pennsylvania, and is under consideration elsewhere. There are a good many difficulties involved in the affiliation with the National Electric Light Association of a body like that which exists in New York, comprising gas companies as well. Mr. Arthur Williams, of New York, spoke strongly against the creation of a new organization, but urged very vigorously the taking of steps which would bring the State body into closer association with the national body, without any loss of freedom or autonomy. He also urged a broadening of the constitution so that affiliation could be pushed in many other directions, and that all the public utilities of the State through their associations could be in close touch and would work in harmony.

Luncheon was served at 1 o'clock at the Engineers' Club in the banquet hall, when a large party sat down and spent a couple of hours. The gathering was addressed by Messrs. T. C. Martin and H. M. Edwards, with regard to technical and other features connected with the Electrical Show, to which all the members in attendance were invited. Particular emphasis was placed by the speakers on the exhibit of historical lighting apparatus and on the collection of electro-mechanical accounting apparatus and methods, as applied to central-station office finance and bookkeeping.

At the afternoon session Secretary C. H. B. Chapin presented a review of opinions delivered by the Public Service Commissions, and Mr. T. R. Beal, chairman of the taxation committee, presented a valuable report bringing out the inequitable condition of gas and electric corporation taxes in New York State. Mr. Hugh T. Wreaks read a valuable statistical paper on the insurance of electric-light and gas plants. Taking the known value of plants and the records of loss by fire, he showed that the corporations were paying premiums altogether beyond the necessities of the case, judged by the law of averages and by the results elsewhere. He called attention to the fact that in

Illinois the state association by its statistical work had succeeded in securing a reduction of the premiums, and pointed out that analogous work was in order in New York, whether by direct pressure upon the insurance companies or even, if necessary, by the creation of a mutual company.

During the afternoon Mr. John W. Lieb, Jr., made a most exhaustive address on the subject of meter testing, the conditions which apply to it, and the present unsatisfactory and incomplete rules which govern the work of the Public Service Commissions, the law being vague on many essential points and unsatisfactory on others to all concerned. As these remarks were not reported Mr. Lieb went into very minute details on several questions, and laid down the basis for work to be done by the association in the future for reducing the practice of both commissions to uniformity and determining conditions as to electric meters which do insure satisfactory results. It was brought out in the discussion of Mr. Lieb's remarks that the report of the meter committee which had been adopted by the association was in reality the report of a committee organized at the initiative of the second district commission, with the co-operation of the association, and it was pointed out by Mr. Paine, of Niagara Falls, who served on the committee, that if the committee were of a semi-public nature the phraseology employed in the report, to which such exception had been taken, would naturally be somewhat different from what it would be if the committee were wholly appointed by the association from within its own membership. It was generally agreed that the question of meter testing was one of the most vital with which the association could deal, and that it was the duty of the association to watch closely every step and action taken in this matter.

Mr. Henry Floy read a paper on the regulation of electric service by commissions, which brought out many interesting points as to the practice of such bodies, showing that such practice is still in the crude and formative stage, and that many points are still left in a state of doubt and uncertainty, not merely with respect to meter testing, but in regard to all the elements of public service supply.

The association concluded its meeting by returning to the constitutional question which had been brought up in the morning, and decided finally to adjourn until the second Wednesday in January, by which time the executive committee will have worked out a new constitution and a scheme which will permit of affiliation with national bodies and which will then be submitted to the membership for its consideration.

In the evening the members attended the Electrical Show in a body, finding much of interest and instruction in the various exhibits, especially those of the central-station companies of New York and Brooklyn.

Economic Power Company Defies Public Service Commission.

The efforts of the Public Service Commission of the Second District of New York to inquire into the methods and business of the Economic Power & Construction Company, with headquarters at Buffalo, have not so far been crowned with much success, although two hearings have been held at which the company was represented. The company was given a special charter by the Legislature in 1893, under which it is granted the right to furnish heat, light and power in any city in the State, to tear up streets and construct plants, or do anything else necessary to further its business without the consent of local authorities. This charter is described by Chairman Stevens, of the commission, as "conferring the most extraordinary powers that were ever granted to any corporation in the State of New York." The stock of the company amounts to $50,000. $1,500 of which was originally paid for in cash and the balance issued to Ernest L. Fasoldt for certain patents. It is said that at the present time 497 of the 500 shares belong to the New York Power Securities Company, a holding company, and one share each belongs to Bert L. Jones, Herbert P. Bissell and Edward M. Mills, of Buffalo. Mr. Jones is the president of the company.

The company having failed to make any annual report to the Public Service Commission, as the commission law provides all public service corporations must do, and having failed to respond to the commission's demands for such a report, an order was adopted by the commission on Sept. 24 commanding the production of all the company's books and papers for investigation. The preamble to this order set forth that "the powers claimed by said company would give to it special and extraordinary rights and privileges possessed by no other corporation, the possession of which is wholly inconsistent with the spirit and purpose of the Public Service Commissions law."

At the first hearing under this order, Oct. 3, the company's president, Mr. Jones, appeared, and with him his attorney, Mr. Simon Fleischmann. The attorney stated that the entire business of the Economic company was in the hands of the New York Power Securities Company, a corporation which he said was capitalized at $2,500,000. When Mr. Jones was put upon the stand and asked about the business and headquarters of the holding company, he declined, by advice of counsel, to answer any questions, declaring that the holding company was not an electrical company and therefore was not within the power of the Public Service Commission for an investigation.

Chairman Stevens then declared that in his opinion the Economic Power & Construction Company was "a mere stalking horse" for the New York Power Securities Company, and said that the commission did not intend that there should be any hiding behind technicalities. Mr. Stevens said that if it were possible for the public service law concerning the supervision of electrical companies to be evaded through the mediumship of a holding company, that the matter should be at once reported to the Legislature, so that this defect in the law could be remedied.

Mr. Stevens further said that from the investigations which the commission had already made, the New York Power Securities Company seemed to have advanced all the money on which the Economic company had been doing business since it began operations.

The hearing was adjourned until Oct. 9 in order to give the Economic company time to consider the position of the commission. On that date Mr. Simon Fleischmann, counsel for the company, flatly refused to disclose any information pertaining to that company, reiterating that the New York company was a business corporation that did not come under the jurisdiction of the commission. He further stated that the charter of the Economic Power & Construction Company was legal and valid, and had been so held by the Appellate Division. Then he read a statement questioning the commission's right to exist. He closed with an intimation that interests connected with the General Electric Company were using the commission to crush a company that might develop into a powerful rival in supplying power. On this latter point he said: "The General Electric interests, in conjunction with the National Electric Light Association, have endeavored to obstruct operations of this company. The Public Service Commission would surely not lend its aid to the General Electric Company's monopolistic interests in their opposition to a recognized competitor. Last week the General Electric Company refused to supply more machinery to the Economic company on any basis."

Mr. Stevens repudiated the intimation that the Public Service Commission was interested in any effort to suppress competition or in furthering the interests of the General Electric Company or any other organization. He repeated, however, his opinion that if the Economic company's charter was valid and it had the rights it claimed, the purpose of the law creating the commission had been defeated.

During the course of the investigation it was stated by the attorneys that the Economic Power & Construction Company had entered into contracts with a construction firm to build plants in these cities of the State: New York, Brooklyn, Buffalo, Schenectady, Syracuse, Yonkers, Albany, Utica, Troy and Rochester. A plant has already been built and is in operation in Geneva.

High-Potential Underground Transmission.

At the meeting of the American Institute of Electrical Engineers, held at the Engineering Societies Building, New York, on Oct. 9, Messrs. P. Junkersfeld and E. O. Schweitzer presented a paper entitled "High-Potential Underground Transmission" which was devoted largely to a discussion of the experience of the Commonwealth Edison Company, of Chicago. Included among the equipment of this company are 272 miles of 9000-volt underground transmission circuits and 11 miles of 20,000-volt circuits; 44 additional miles of 20,000-volt underground lines are under construction, so that the total will be 55 miles. Portions of the 9000-volt circuits have been in use for about 10 years, while the 20,000-volt circuits were installed about a year ago.

The authors state that the early experience showed the necessity for avoiding sharp bends and for using extreme care in making splices. A small number of burnouts occurred during the first year's operation at 9000 volts; nearly all of these were due to sharp bends or to moisture at the joints. In the first installation use was made of paraffine at the joints and in the terminal bells, but being hygroscopic in effect, due to voids left after cooling, the paraffine was not found satisfactory. A high-grade insulating compound is now used for all high-potential work. The compound is poured into the sleeve at a temperature of 150 deg. C. in a manner to exclude all moisture. The success of this work is evidenced by the fact that there have been only two failures in splices during the last 5½ years, and there are now about 3400 splices in the high-tension system. The compound-filled terminal bells were formerly made of brass cylinders with a cast-brass base. On some recent work a few bells made of a special impregnated concrete have been used with very satisfactory results.

A considerable portion of the paper was devoted to a description of spark-gap and oscillograph investigations of the performance characteristics of cables. The oscillograms included current and pressure waves for all principal switching operations, as well as for a special cable connection in which resonance was supposed to be produced. However, none of the records showed any appreciable excess e.m.f. on the 9000-volt system. The spark-gaps which were placed on the 20,000-volt line indicated that pressure rises in excess of 100 per cent occur occasionally. The oscillograms obtained gave no clear evidence of the cause, but the cable "broke down" three times within 15 months. This record is considered reasonably satisfactory because it was expected that weak points would develop during the first year's operation.

As results of experience and the investigations the authors drew the following conclusions concerning high-tension underground transmission:

1. Underground cable systems operating at not over 11,000 volts, if properly made and installed, will give at least equally as reliable service as most of the other elements in an electric energy transmission system of which the cable is a part.

2. When local and commercial conditions justify, pressures as high as 25,000 volts can be satisfactorily used, even for systems containing as much as 100 miles of cable. If higher voltages are needed to meet the operating requirements, and can be justified commercially, special construction will be necessary in order to overcome the limitations of paper, rubber or varnished cambric insulations, and also in the standard forms of underground conduit or subways used in this country.

3. On comparatively short lengths underground or underwater cables operating at e.m.fs. of 40,000 volts can be used in connection with long overhead transmission lines.

4. Potential rises of 50 per cent or 100 per cent are not uncommon on large underground cable systems, although this fact may not always be manifest because the factor of safety used is high.

5. Definite knowledge of what actually occurs in large high-potential underground systems is still meager, especially regarding intensity and frequency of surges, heating effects and critical temperatures for various kinds and thicknesses of insulation, corona effects and similar matters.

DISCUSSION.

In opening the discussion on the paper, President Ferguson remarked that with the extensions of the congested areas in our large cities the use of high-potential underground transmission becomes more and more urgent.

A written communication from Mr. Charles H. Merz, of New Castle-on-the-Tyne, England, was read by Prof. H. E. Clifford. Mr. Merz discussed the advantages and disadvantages of the three common methods for placing cables underground; that is, the duct method, which is employed in America; the solid method, which is common in England, and the armored-cable scheme which is frequently used on the Continent. The duct system is well suited for use in congested areas in that it affords ready accessibility, but it involves a great expense and is subject to rapid deterioration. Armored cables when in position cost from 10 to 15 per cent more than a solid system, but they have proved satisfactory when covered with suitable waterproofing. There are many objections to the duct system, a prominent one being the high initial cost when provision is made for cables which could not be installed for many years. Mr. Merz expressed the opinion that the solid or an armored cable system is preferable to the duct system. He stated that experience has proved 20,000-volt underground circuits to be just as reliable as 5000-volt circuits, and that no dangerous surges had been observed. In any cable system the joints are found to have the lowest power factor of safety, and prove to be the weak points of the system.

Mr. H. W. Fisher expressed the hope that other papers similar to that of the author's will be presented in the future to give additional data concerning the performance of cables. He suggested the use of a testing voltage of at least 2.5 times the normal working e.m.f. He discussed in detail the importance of taking extra precautions in making joints in the cable and then employing a proper insulating composition for covering the joint.

Mr. H. G. Stott said that certain lead cables which had been installed in Buffalo in 1891 for a 3000-volt service have been in continuous use since that time, and are now carrying energy at 7500 volts. These cables are of the rubber-insulated lead-covered type. Observations of the defects which developed in the high-tension cables employed in New York have shown that on the basis of the breakdowns per mile per year, since the year 1902, the faults have decreased in value relatively as about 18 to 1. The high value when the systems were first being installed was attributable to imperfections in installation. Oscillograph records have shown the existence in cables of waves in which even the ninth harmonic was prominent. The damage which follows the development of the fault in a cable depends, to a large extent, upon the rating of the equipment connected to the cable system. Thus, on short-circuit a large generator will cause considerably more damage than a small generator. When induction generators are used the damage is practically eliminated, because this type of generator tends to decrease its voltage to zero on short-circuit.

Mr. E. J. Berg said that during a certain series of tests made on the Brooklyn Edison Company's 6000-volt system, which is operated without a grounded neutral, at certain times, though not frequently, double the normal circuit voltage was observed. He expressed the opinion that 20,000-volt underground systems are thoroughly reliable at the present time. When higher voltages are employed it may become necessary to resort to single-conductor cables rather than to three-conductor cables. The high value of initial current taken by a transformer when connected to a system can be attributed to the excess value of the magnetization in the core. The current rush can be minimized by operating transformers at a low normal magnetic density.

Mr. Wallace Clark said that it is not essential to test cables in actual operation at excessively high voltages. It is desirable, however, to test them frequently so as to detect and eliminate electrolysis. He remarked that 25,000-volt cables as built at the present time are so reliable that they can be used in locations

where the expense connected with them is justified. In any event, the factor of safety in insulation should be kept high.

Mr. Alex Dow stated that certain cables which had been installed in Detroit in 1892, and have been in continuous service since that time, are as good as new at present. He said that during 13 months' use of a certain 7.5-mile cable operated at 23,000 volts faults developed six times, five of the causes being unknown. Four of the faults occurred between conductor and ground, and two between conductors. He remarked that it is essential in forming a joint in the cable to exclude all air. According to present methods of making a joint and insulating it, the time required is entirely too long; ordinarily a whole day is consumed in this operation. Every effort should be made to minimize corona effects, and a higher factor of safety should be used in the insulation. Mr. Dow expressed his disagreement with Mr. Merz concerning the relative advantages of duct and solid systems of laying cables. He explained that although solid systems are proper for the conditions existing in a community where extensions are seldom made, such a system is not applicable in America where one must provide for enormous increases at rapid rates.

Mr. Warren Partridge related the experience of the Public Service Corporation of New Jersey with 13,000-volt cables. He said that during the past three years only 7 per cent of the troubles in the system to which the cables are connected could be attributed to the cables.

Prof. E. E. F. Creighton called attention to the fact that even under normal operating conditions without any external disturbances, extra high voltages may be produced within a system. The main disadvantageous condition in cable operation is the existence of an arcing ground.

Mr. Henry Floy stated that 25,000-volt cables are absolutely reliable, and that even at the present time voltages as high as 75,000 can be employed with cables. However, the commercial advisability of using such a high e.m.f. is to be doubted. An e.m.f. of from 35,000 to 40,000 volts is a practicable one, commercially.

Dr. C. P. Steinmetz explained that the destructive effect of a fault in a cable depends not only upon the rating of the equipment, but upon the electric, magnetic and rotative energy stored in the circuits and revolving machinery. Thus the instantaneous rate of flow of energy may be enormously greater than the combined rating of all of the equipment connected to the cable system. He stated that a study of transient phenomena in electric circuits by all operating engineers is to be desired. He suggested the use of inductors and condensers connected with air-gaps, so arranged as to show the frequency, voltage and current of all surges occurring in the system. In discussing the oscillograph, Dr. Steinmetz said that in the near future this instrument will be looked upon as the indicator mechanism of the electrical engineer, who will depend upon it just as the steam engineer depends upon his indicator mechanism for observing the performance of the steam engine.

Lead-Covered Cables Injured by Insects.

The Home Telephone Company, of Santa Barbara, Cal., has been having considerable trouble from perforations in its lead-covered cables made by insects. Some of the trunk lines consisting of 300 to 500 wires in lead casings, have been found to have hundreds of perforations about ⅛ in. in diameter, evidently made by the insects, with the result that there has been considerable interruption of telephone service.

This kind of damage to lead-covered cables was made the subject of a paper by Mr. John Hesketh, electrical engineer for the State of Queensland, Australia, presented before the St. Louis International Electrical Congress of 1904. The matter was investigated by Mr. H. Tryon, entomologist for the Queensland Department of Agriculture, who reported that the greatest damage to the cables was caused by the larva of the beetle *Eceloneru*s, but that the beetle *Xylopertha* and also the beetle *Bostrichus Jesuita* were taken from holes in lead casing. In experimenting with other insects it was found that the elephant beetle would gnaw through the lead sheathing of a telephone cable, and also the caterpillar *Xyleutes boisduvali*. In the discussion of Mr. Hesketh's paper, a case was noted where a grub about 1½ in. long had done considerable damage to cables in Savannah, Ga., and an article in these columns in the issue of July 16, 1904, gave an account of similar damage to cables in Shanghai, China, but which was ascribed to wasps.

Improvements at the Massachusetts Institute of Technology.

The completion of the new Tech Union building at the Massachusetts Institute of Technology has released space for the installation of several new pieces of experimental apparatus in the laboratories of the Pierce Building, including a 500-kw Westinghouse-Parsons steam turbine, an American superheater with a capacity of 10,000 lb. of steam per hour, an Alberger condenser, a Lawrence centrifugal pump, and a Westinghouse water brake for testing. The boiler plant has also been increased in capacity by the addition of 1000 hp in water-tube boilers. Steam will be supplied to the turbine at 250-lb pressure and at 250 deg. Fahr. superheat, with arrangements for the use of saturated steam when desired. The turbine foundation is of I-beams laid on cinder concrete, the apparatus all being carried high enough above the floor to ensure easy accessibility. The centrifugal pump will be driven by a 35-hp vertical engine.

An option in steam-turbine engineering has been introduced into the mechanical engineering course this year, particularly to afford instruction to mechanical engineers interested in power-plant work and students of naval architecture and marine engineering. Prof. Peabody's "Thermodynamics" has been rewritten with the special object of placing the computations for the steam turbine on a level with those for other heat engines, and the book of the same author on the "Properties of Steam" has also been revised and enlarged.

New Method of Resuscitation from Apparent Death.

In *Collier's* of Sept. 12, Dr. Woods Hutchinson gives an account of a new method of resuscitating the drowned, which is stated to be a radical improvement over methods formerly used. Several years ago a commission headed by Prof. Schaefer, of Edinburgh, was appointed by the British government to determine the best means for resuscitating the drowned, and after making a thorough scientific investigation of the subject, this body reported a method which has been adopted by the Royal Humane Society, the Royal Life Saving Society and the Coast Guard of Great Britain.

The several artificial methods of respiration previously used were condemned, two as being utterly inadequate and a third as dangerous. One of the former is the well-known Sylvester method which consists in pulling the arms of the subject up over the head and then pressing them down firmly on the chest. One of the most important features of the new method is in turning the subject face downwards and not on his back; the investigation showed that when lying on his back real death to a subject may result from a profuse pouring out of mucus from the throat, wind-pipe and lining of the bronchial tubes, which is churned by the violent effort of respiration into a froth, the smaller air tubes and air cells thereby becoming plugged up and making it impossible to get air into the deeper part of the lungs. This fact is said to account for those puzzling cases in which individuals have been taken out of the water a very few seconds after breathing had ceased and yet who died in spite of everything that could be done to resuscitate them. As the method of artificial respiration devised is directly applicable to cases of suspended life arising from electrical shock, the directions for carrying it out are given herewith:

The individual whom it is desired to resuscitate is promptly, and without a moment's delay in either loosening clothing, drying, warming, or shaking the water out of the lungs, turned upon his stomach upon the shore, or other level place, the face being turned to one side so that the nose and mouth are clear of the ground. Then the operator kneels, either by the side of or astride of the patient's hips, facing toward his head, places both outspread hands upon the small of the back, just over the shortest ribs, and pitches his body and shoulders forward so as to bring the whole weight heavily upon the body of the victim. This downward pressure should take about three seconds. He then swings upward, lifting his hands off suddenly and quickly. The elasticity of the ribs and of the contents of the abdomen cause the chest to expand. In three seconds more the process is repeated, and so on, indefinitely, making ten or twelve of these movements per minute. The position allows the tongue to fall forward, and any mucus or water which may be present in the lungs to readily escape through the mouth. By simply swinging backward and forward, throwing the weight of his body upon the waist line of the victim, any operator of modern intelligence and of most moderate strength, even a delicate woman or child, can gain a sufficient inflow of air, flowing in and out through the lungs of the patient, to supply him with as much air as would be taken in if he were able to breathe voluntarily. Promptness in beginning the pumping operation is imperative.

Historical Books at the New York Electrical Show.

By Brother Potamian, Sc.D., Lond.
Professor of Physics in Manhattan College, New York.

An interesting feature of the Electrical Exposition at Madison Square Garden is a collection of early works on electricity from the library of Mr. Edward Caldwell, of New York. Each book is a treasure in itself, being either a first or a second edition of a work on electricity, embodying the researches, discoveries and inventions of the author whose name stands out prominently in the history of the world's indebtedness to science.

Indifference is hardly possible when looking at these old volumes, which cost so much thought and labor, so much mental concern and such pecuniary outlay; volumes some of which mark epochs in the conquest of nature's forces; while others, by a process of gradual development, made possible the marvelous electrical display daily witnessed in the halls of the "Show," as the Exposition is popularly called.

The place of honor in the collection is rightly given to Gilbert's great work on magnetism and terrestrial magnetism which was published in the century year 1600, after twenty years of consecutive research and laborious experimentation on the part of the author, not to mention the heavy expense connected with such a prolonged period of investigation. This is represented by two editions, the first, printed in 1600, and the excessively rare edition of 1628, printed in Stettin; no other copy of the latter is known to be in any library in the New World. Close to "De Magnete," on the right, is the magnificent page-for-page translation made in the tercentenary year 1900 by the members of the London Gilbert Club, prominent among whom are Dr. Joseph Larmor and Prof. S. P. Thompson.

In close proximity to the old volumes of the "Philosopher of Colchester" is one of considerable celebrity in the annals of electrical discovery. It embodies the painstaking work carried on for years at Ferrara by Cabeo, the Jesuit, and published by him in his *Philosophia Magnetica* in 1629. This fine folio stands open at a page which shows the sympathetic telegraph, or the "lover's telegraph," as it was often called from Addison's description of it in *Spectator* No. 241. By means of a magnet and a dial-plate with the letters of the alphabet distributed around the periphery, two friends, it was said, could convey their thoughts to each other in an instant over islands or continents, cities or mountains, ocean or desert. This so-called telegraph, *wireless* with a vengeance, was indeed a canny conceit, which was soon utterly disproved and shown to be a practical impossibility. Like certain other magnetic myths, the lover's telegraph died a hard death.

This work of Cabeo contains on another page the first diagram in print of the magnetic field of a lodestone as mapped out by a plenteous sifting of iron filings in its neighborhood, resulting in thick tufts at the polar ends with curved lines around the middle part of the stone.

More important still is a statement made on another page of this famous book, which statement contains the first recognition by any writer of *electrical repulsion*. Despite Gilbert's diligence and perseverance, he failed to discover this remarkable repelling property of similarly electrified bodies, thereby leaving it to be found out a quarter of a century later by this Italian investigator.

The great pioneer in the study of atmospheric electricity is represented in Mr. Caldwell's collection by the first five editions of Franklin's "Experiments and Observations on Electricity Made at Philadelphia in America"; the first edition, consisting only of 86 pages, appeared in 1751; and the fifth, of 514 pages, in 1774. Close to these memorable works, the first fruits of American science, are the two French translations of 1752 and 1756, which did so much to make the name of our patriot and statesman known in the capitals of Europe, and in their schools and universities.

Next to these century-old volumes of our illustrious countryman is the great work of his English friend and admirer, Priestley, who does not fail to give the American colonist a fine place in the pages of his "History of Electricity," 1769.

Of other early American works on electricity included in the collection we will mention only two. The first is Gale's "Electricity, or Ethereal Fire," Troy, 1802, which is considered the first book on medical electricity written in the country, a book in which it is seriously affirmed that electricity is "the best family physician ever extant." The second work is "An Epitome of Electricity and Magnetism," published anonymously in 1809, and which contains a carefully written account of contemporary experiments and investigations in Europe and America. This quarto of 159 pages was written by Messrs. Green and Hazard, of Philadelphia.

The student of telegraphy will be glad to see the pamphlet of Ronalds, 1823, in which he describes his system of electrical transmission of signals to a distance by means of static electricity, which experiments he successfully carried out in the year 1816. Like most inventors, Ronalds (Sir Francis) met with a bitter disappointment, a discouraging setback. Having urged the adoption by Government of his mode of electric signaling in a letter which he wrote to Mr. Barrow, the representative of the British Government, that gentleman politely informed him that *telegraphs of all kinds are wholly unnecessary*. Probably Mr. Barrow had in mind the mechanical or semaphore telegraph which conveyed the result of the battle of Salamanca (July 22, 1812) from Plymouth to London, on which occasion the message was interrupted by a fog after the transmission of the first few words, viz., "Wellington defeated." With that comforting piece of news Londoners generally, and members of the Government in particular, had to retire for the night's rest. Next morning came the remainder of the interrupted dispatch, "the French at Salamanca!"

We were glad to see once more Ampère's "Recueil d'Observations Electro-Dynamiques," 1822-24, for these celebrated papers opened up a new vista in mathematical physics and gave a complete analysis of what we call to-day the mutual interference of magnetic fields, whether due to two conductors conveying currents or to one conductor and the earth's "orb of virtue" itself. Ohm's "Galvanische Kette," 1827, was fittingly placed beside Ampère's masterly application of the calculus to the mutual action of currents. The French physicist gave us the fundamental law of electro-dynamics; the Ger-

man laid down in his book of 245 pages the law of the electric circuit. The names of both electricians will go down to remote generations for their association with the practical units of current and resistance, as well as for the splendid achievements for which they stand.

In submarine telegraphy there are many interesting books and pamphlets, conspicuous among which is Mullaly's fine volume on the Atlantic Cable of 1858. This is the standard work on the subject, as the author was on board the U. S. frigate *Niagara* as secretary to Professor Morse in the abortive attempt to lay the cable of 1857, and subsequently as member of the staff of Cyrus W. Field in the two expeditions of 1858, which resulted in the laying of the great "cord" in 2000 fathoms of water. Not far from Mullaly's book, but in an adjoining case, was the *gun-cap* cell with which Mr. Dickerson outdid Latimer Clark by sending a message from Heart's Content to Valentia through the cable of 1866. Though of Lilliputian dimensions, no one with the most elementary knowledge of physics could pass by such a "battery" without a feeling of wonder at the energy which the historic cell was able to transmit through 2000 miles of submerged cable.

Of other works displayed in Mr. Caldwell's unique exhibit mention will be made of only two. One is an article by Prof. Silliman, in which he describes an electric railway devised and operated on a model scale by Thomas Davenport, of Vermont, as early as 1835; and the other the first edition of Pope's "Modern Practice of the Electric Telegraph," which has already reached its fifteenth edition.

There are many other interesting volumes in the two cases assigned to Mr. Caldwell, notably those referring to the work of Henry, Sturgeon, Morse and Vail; and also some papers of particular interest, especially those of Cyrus W. Field, relating to the great enterprise with which his name will ever be associated; but for the purpose of this article it will be sufficient to say that the merits of these men, whether as investigators of the properties of electrical currents or as benefactors of humanity in the application of the currents to the transmission of intelligence to the ends of the world, are so well known to the ordinary reader as to need no paraphrase in this brief appreciation of the historical works of the Electrical Show of 1908.

Convention of Western Association of Electrical Inspectors.

The fourth annual convention of the Western Association of Electrical Inspectors will meet at the assembly room of the Chicago Board of Underwriters, on the twelfth floor of the National Life Building, Chicago, Oct. 20, 21 and 22, 1908. The first session will be held at 10 a. m., Oct. 20. As will be seen from the following list, the program to be considered is one of much interest.

Reports of committees will be presented on the following subjects: "Uniformity in Rulings," Mr. William S. Boyd, secretary; "National Electrical Code," Mr. J. H. Montgomery, chairman; "Outside Wiring," Mr. Waldemar Michaelsen, chairman; "Grounding of Conductors for Safety," Mr. Frank R. Daniel, chairman; "Theater Wiring and Show Equipment," Mr. Henry C. Harris, chairman; "Architects' Specifications," Mr. F. H. Moore, chairman.

Papers will be presented as follows: "Grain Elevator Wiring," by Mr. Charles Nutter, electrical engineer, Atchison, Topeka & Santa Fe Railroad, Topeka, Kan.; address, "Electrical Inspection from the Viewpoint of the Central Station," by Mr. William H. Blood, Jr., insurance expert, National Electric Light Association, Boston; "The Underwriters' Laboratories and Their Work," by Mr. William H. Merrill, manager, The Underwriters' Laboratories (Inc.), Chicago. There will be a discussion on electrical inspection, and on Wednesday the members will witness tests of electrical fittings at the Underwriters' Laboratories. Mr. William S. Boyd, 125 Monroe Street, Chicago, is secretary.

Regulation of Electric Services by Commissions.

In a paper presented last week at the meeting of the Empire State Gas & Electric Association, Mr. Henry Floy discussed the limitations of the functions of Public Service Commissions. While approving of the principle of governmental supervision of public utilities, this, he thinks, should be confined to investigation of general conditions and subsequent regulation, based on intelligent and fair conclusions by State commissions, provided that by investigation is not meant inquisition, and by regulation, operation. When, however, the commissions are as honest, energetic and as desirous of being fair to both the public and the corporations as are the New York State commissions, the companies affected should facilitate their duties, educate them and co-operate in their work. He stated that the Empire State Gas & Electric Association early recognized the changed conditions of the times, and since the New York State commissions were appointed, has, in a frank, fair way endeavored to co-operate with them in their efforts to control and regulate the gas and electric companies of the State, with the result that its proper influence and intelligent suggestions are evident in existing regulations and requirements of the commissions. The corporations and their representatives, either directly or through associations, should interest themselves in the work and plans of the commissions, with a view to securing the best results both to the corporation and the public resulting from joint co-operation. This has not always been done, for while the commissions arranged for informal conferences, invited suggestions and plans for methods of accounting and reporting from the public service corporations throughout the State, the conferences were slimly attended and the suggestions meager and critical rather than helpful and suggestive.

Referring to a recent amendment to the New York public service law, section 66, paragraph 3, which states that the commissions shall "Have power to . . . prescribe methods of regulation of the electric supply system as to the use for incandescent lighting, and fix the initial efficiency of incandescent lamps furnished by persons, corporations or municipalities generating and selling electric energy for lighting," Mr. Floy stated that if the companies throughout the State are opposed to the wording of a suggested amendment, whereby the commissions shall have power "by order, to prescribe the nature, class, kind, character and efficiency of the electric supply system, of the current supplied and of the lamps furnished by persons, corporations or municipalities generating and selling electric energy for lighting," now is the time for them to approach the commissions and legislators with their arguments and reasons for modifications. Is it advisable, for example, that the commissions have power to specify the kind, character and specific consumption of incandescent lamps? Instances were cited indicating a possible tendency on the part of the commissions to abrogate and assume to themselves uncalled-for and improper responsibilities, which is a matter that should be considered, discussed and, after proper conclusion, taken up with the commissions in a mutually frank way.

Brooklyn Section of N. E. L. A.

Realizing the advantages to be gained through membership in the National Electric Light Association, 138 employees of the Edison Electric Illuminating Company, of Brooklyn, met on Oct. 2 and formed the Brooklyn Company Section of the National Electric Light Association. This meeting was in reality an adjourned session of the one held the week previous, as noted in these columns, at which time an organization committee was appointed to nominate officers and draw up a constitution and by-laws.

The organization committee presented the folllowing nominations: Chairman, G. L. Knight; vice-chairman, P. D. Sharkey; secretary, E. A. Baily; treasurer, I. Bugg, together with

an executive committee, consisting of 12 members, one from each department of the company.

The election of the nominees as presented was unanimous. It is the intention of the Brooklyn Company Section to meet three times during the year, at which times papers will be presented and discussed, and to hold its annual meeting and company convention as soon as convenient after the National Electric Light Association convention.

Novel Turbine Installation for New York Subway.

The General Electric Company is making for the Interborough Rapid Transit Company a novel generating unit which will be installed in the power house at Fifty-ninth Street and Eleventh Avenue next March and subjected to thorough tests before acceptance. A 5000-kw low-pressure turbine will take the exhaust of one of the present 5000-kw reciprocating compound engines, thus making a triple-expansion combination. The turbine will be directly coupled with an induction generator rated at 5000-kw, three-phase, 25 cycles, which will be connected without switching apparatus to the leads of the reciprocating engine generator. The low-pressure turbine is to have no governor and will be controlled in speed by the generator, which latter will be controlled, as at present, by the governors on the reciprocating engine. The turbine is to be of the vertical-shaft, three-stage Curtis type. It is stated that double the output will be obtained from the combined unit over that obtained formerly from the reciprocating engine alone, and at a greatly reduced steam consumption per kw-hour. It is also expected to separate the oil from the steam before it enters the turbine, so that the condensed steam can be used over again in the boiler, thereby effecting a large saving in the quantity of water used.

An elaborate series of tests of the new apparatus will probably be commenced in April, and will continue several months with the view, if satisfactory results are obtained, of adopting the same principle with other units in the same power house.

A Belated Nernst Patent.

A patent was issued Oct. 6 to Prof. Walther Nernst on an application dated more than 10 years ago, namely, March 29, 1898. After a statement of the now well-known principles of the Nernst glower, the specifications recite that while the invention contemplates the employment of any one of a considerable variety of mixtures of materials, mixtures of two or more of of oxides of zirconium, yttrium, thorium, beryllium and magnesium will generally be found most desirable. One of these oxides, such, for example, as the oxide of magnesium, may, however, be combined with a small percentage of boric acid, chloride of calcium, tungstic acid, or the like.

The principal claim of the patent is on "An improved glower for electrical incandescent lamps which is a non-conductor when cold, but which becomes a good conductor and incandescent under the action of an electric current at high temperatures, and which consists essentially of a mixture of refractory metallic oxides."

CURRENT NEWS AND NOTES.

TEST OF ELECTRIC METERS.—The up-State New York Public Service Commission has reported that of 5894 electric meters tested in the month of August, 61.8 per cent were accurate within 4 per cent; 10.6 per cent were 4 per cent or more fast, and 27.6 slow.

ELECTRIC TRACTION IN THE ADIRONDACKS.—At a meeting this week of the up-State New York Public Service Commission, to which officials of railroads operating in the Adirondacks have been summoned, the subject of the prevention of forest fires will be discussed, and the electrification of the Adirondack lines will be considered.

ELECTRICAL WORKERS' OFFICERS.—At a meeting held in St. Louis Sept. 26, the International Brotherhood of Electrical Workers elected the following officers: General president, J. J. Reid, of Erie, Pa.; general secretary, J. W. Murphy, of Cleveland, Ohio; general treasurer, F. J. Sullivan, of Cleveland, Ohio; vice-president, Oliver Meyer, of Ashtabula, Ohio.

CIVIL SERVICE EXAMINATION.—The United States Civil Service Commission will hold an examination on Nov. 9 to secure eligibles for a vacancy in the position of electrical engineer in the technologic branch of the Geological Survey, at a salary ranging from $1,620 to $3,000 a year. Data as to the competition can be obtained from the commission in Washington.

ELECTRICAL FARM.—Mme. Davidoff, a writer for magazines, has announced that she will establish a farm on Long Island where fruits and flowers will be grown every month in the year by the aid of electricity. She states that her system of electrical culture differs from that recently described by Sir Oliver Lodge, in that the plants are all grown under glass, and that under certain conditions a static machine will be used instead of a dynamo.

WIRELESS TO HAWAII.—Communications by wireless telegraphy has been opened between a station at Kuhuku, Hawaii, and Russian Hill, San Francisco, the distance being 2089 miles, or considerably greater than between the Marconi transatlantic stations. It is stated that long messages are satisfactorily received at Russian Hill, and that in sending from there only half the power of the station was employed.

TWO-CENT POSTAGE between the United States and Great Britain went into effect Oct. 1. Its steadfast advocate, Mr. Henniker Heaton, received a wireless message in London from Mr. Marconi in Canada congratulating him on the inauguration of the penny postage between the United States and Britain. He added: "I hope, with your assistance to see telegraphic communication established between the two hemispheres at a penny a word."

CHICAGO ELECTRICAL SHOW.—The fourth annual Chicago electrical show, to be held in the Coliseum, that city, Jan. 16 to 30, 1909, will, it is claimed, far surpass anything ever attempted in the line of electrical shows, judging from preparations now being rapidly made. The handsome decorations of the 1908 show are being enlarged upon and exhibits of many large companies are being prepared on plans more comprehensive and attractive than previously, working power exhibits being an added feature. Weber's Prize Band, which rendered such delightful music at the last show, has been re-engaged.

LIGHTING COUNTRY HOMES BY PRIVATE ELECTRIC PLANTS.—Bulletin No. 25 of the Engineering Experiment Station of the University of Illinois calls attention to the fact that the present state of development of the storage battery and the recent production of the efficient tungsten filament incandescent lamp have opened up new possibilities in the way of country home lighting by private electric plants. The paper includes some explanations concerning artificial illumination, the selection of lighting fixtures and the planning of a house-lighting system, the design and estimate of the cost of a small private plant, suggestions about ordering apparatus and instructions for its operation and care. The bulletin is intended for the non-technical reader, and an attempt has been made to show the steps in the design in such a clear and simple manner that any person could decide upon the equipment needed and order it intelligently.

Wiring and Lighting Equipment of the Stack Room of the New York Public Library.

By J. F. Musselman, Jr.

THE book-stack section of the new public library building at Fifth Avenue, Fortieth and Forty-second Streets, is a seven-story, fireproof structure extending across the rear of the building and cut off from the other parts of the building by fire walls. The section is 297 ft. long by 78 ft. wide, and has book stacks containing about 63 miles of shelves to accommodate 2,700,000 volumes. Nothing combustible enters into the construction of this room or its furniture, all stacks and shelves being of iron, and all floors of white marble slabs. Each story is 7 ft. 6 in. in height, and the stacks extend from floor to ceiling with iron diaphragms 3 in. above the marble floor slabs to accommodate the lowest tier of books, and adjustable shelves above extending up to the floor slabs of the next story. All of the book stacks in the main blocks are double; that is, arranged with two sets of shelves to hold books on either side. The passages between the stacks are about 3 ft. wide, and there are 28 passages on each floor to each of the four blocks.

To light the space in a satisfactory manner, and to give the required results in the operation of the library, the following conditions obtain:

All book shelves of the stack room will be lighted to such

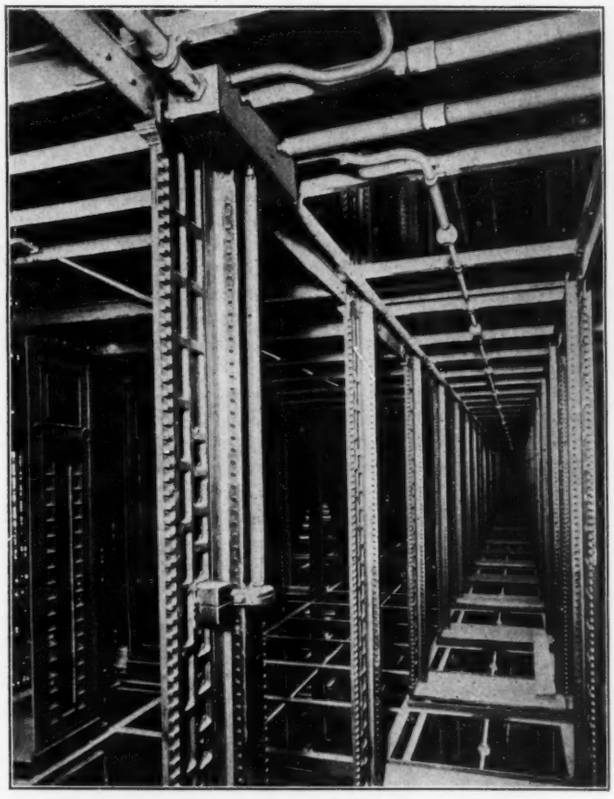


FIG. 1.—REMOTE CONTROL SWITCH POINT.

an intensity that the title of a book in any part of any stack can be read without difficulty without tilting it on the shelf.

The main aisles and working spaces of the stack room are controlled independently of the lighting in the stack spaces and will be lighted to such an intensity that the markings on the ends of the stacks can be easily read.

The control of the lamps in the stack passages will be in sections, so that it will not be necessary to burn all lamps of any floor to handle the books of any section of the stack room; and so that the lamps of any section can be controlled either from the center aisle at either end of the section or from the operating desk at the center of the stack room, where the book lifts to the reading room are located, to and from which nearly all books are to be handled.

A number of the lamps of the room are on a night-light feeder, so that the watchman can inspect all parts of the stack room when the main feeders are not in service, and these watchman's lamps are so controlled that a watchman entering or leaving a floor at any entrance can switch the night lamps on or off.

The lighting fixtures are of such a design as to reduce the head room in the aisles and stack passages as little as possible.

The conduit work is installed in such a way as to be as

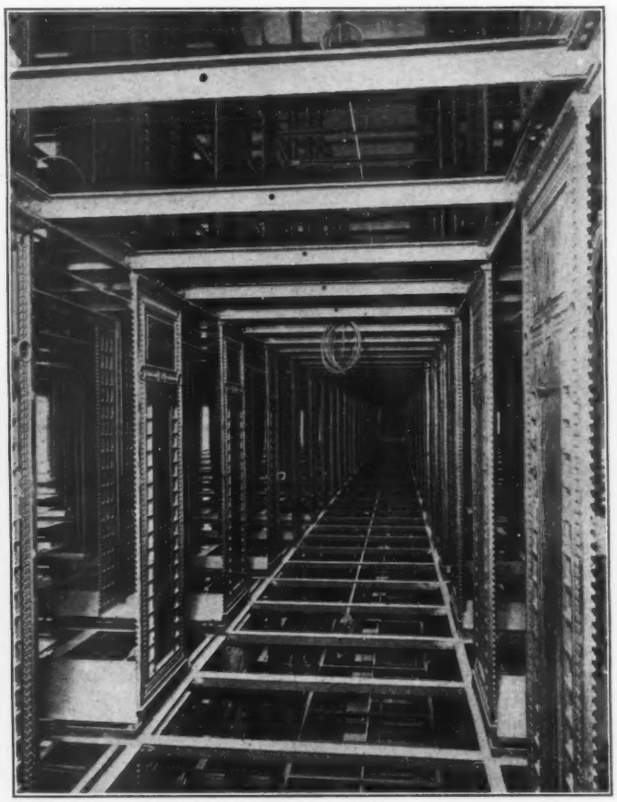


FIG. 2.—VIEW OF CENTER AISLE OF STACK ROOM FLOOR.

unobtrusive as possible; it occupies no book space, and harmonizes with the design of the book stacks.

The titles on the backs of a great many books of the library are apt to be dim and to require a rather high intensity of illumination to be legible without tilting the volume. To facilitate the operation of the stack room without an unnecessary waste of electricity 0.7 foot-candles normal to the back of the books on the lowest shelf of the stacks was selected as the most satisfactory intensity. The construction of the stacks is such that all shelves are divided by vertical cast-iron supports into sections 3 ft. ½ in. long. This made a spacing of 6 ft. 1 in. on centers for lamps in the stack passages the most satisfactory distribution. In order to give the proper concentration to the light and at the same time to save the space which a reflector would take up, a 50-watt reflector lamp of the type shown in Fig. 10 was selected. This lamp has a candle-power curve approximately as shown in Fig. 11, and this, with the reflection from the white marble floor, brings the brilliancy up to the required point. The total space occupied by this unit set in the receptacle and box described below is about 5½ in. from the bottom of the floor slab above.

The construction of the book stacks is of light steel shapes to support the marble slab floors in the aisles and passages and the steel diaphragms at the bottom of the stacks. All of these shapes in the stack portions of the room run transversely and are set with their webs up, that is, with their flanges horizontal and almost flush with the bottom of the floor slabs.

Thus by making all runs of branch circuit conduit in the stack spaces longitudinal no drilling was necessary for these circuits. The webs of the tee bars used in the aisles were turned down, and these were drilled to admit the aisle conduits, as shown in Fig. 2. The ends of all stacks are of cast iron of ornamental design, perforated as shown in the cuts.

The distribution for each floor is made from four points one at each end and two on one side. equidistant from the center. Each of these distribution points is provided with electrical energy for stack lighting, which is to be turned on only when the library is in operation, and for night lighting, which

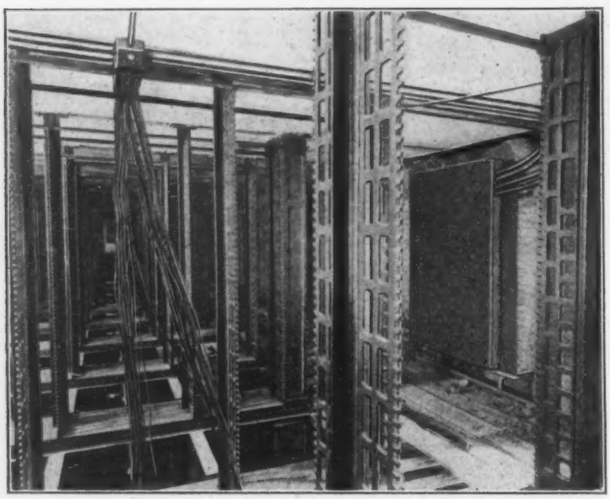


FIG. 3.—PULL BOX CONNECTION TO DISTRIBUTION BOX.

will be constantly in service and will be used by the watchmen. These eight lighting feeders run from the main switchboard to centers of distributlon in the fourth floor distribution boxes, from which mains loop up and down through the other distribution boxes of their respective risers. The distribution system of the building is two-wire, 235-volt.

The lamps in stack passages of each of the seven floors are divided into 12 sections, and each section is controlled separately by electrically-operated, remote-control switches placed in the distribution boxes and controlled from points in the center aisle near the ends of their respective sections. Each of these switches is also controlled from points at the central desk, so that all lamps can be switched out of circuit by the operator without the necessity of returning to the aisle control point. All of the lamps in the aisles are placed on the night light feeders, so that they can be used at any time, night or day, and are controlled at the ends of the stack room near the stairs and at the center desk. A single lamp is placed near the foot of each set of stairs on each floor, and all of these are

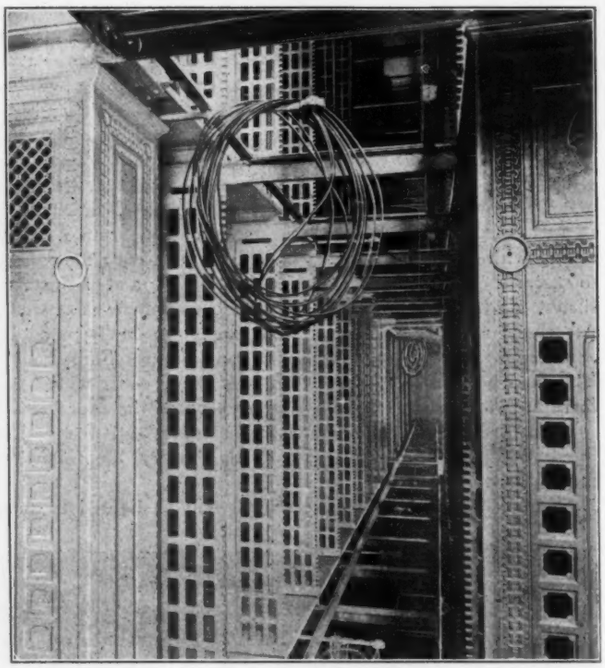


FIG. 4.—STACK PASSAGE, SHOWING ONE END OF BRANCH RUNS.

controlled by three-point switches at the lowest and highest stack floors. These lamps are intended for the watchman's use, and the circuit for them runs vertically from top to bottom of the stack room looping into the outlet on each floor. The arrangement of circuits and locations of lamps are shown in Fig. 6, a partial plan of a typical floor which shows all runs of conduit and the location of the distribution points. The

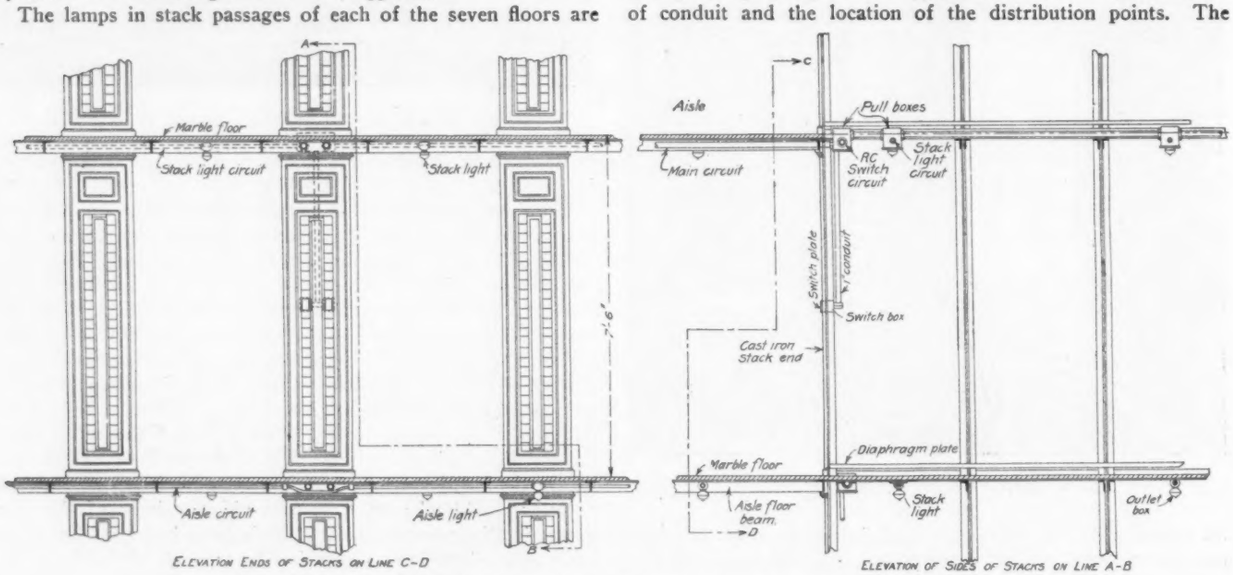


FIG. 5.—DETAILS OF LIGHTING CIRCUITS IN MAIN STACK ROOM.

lamps around the operating desk and stairway in the center of the room are on three circuits separate from those in the stack passages and aisles, and, for convenience in operation each of these circuits is on a separate remote-control switch controlled from the center desk.

From the detail of a typical distribution box, Fig. 7, it will be seen that each of the branch circuits is controlled by a knife switch, and all of the branch circuit switches for one

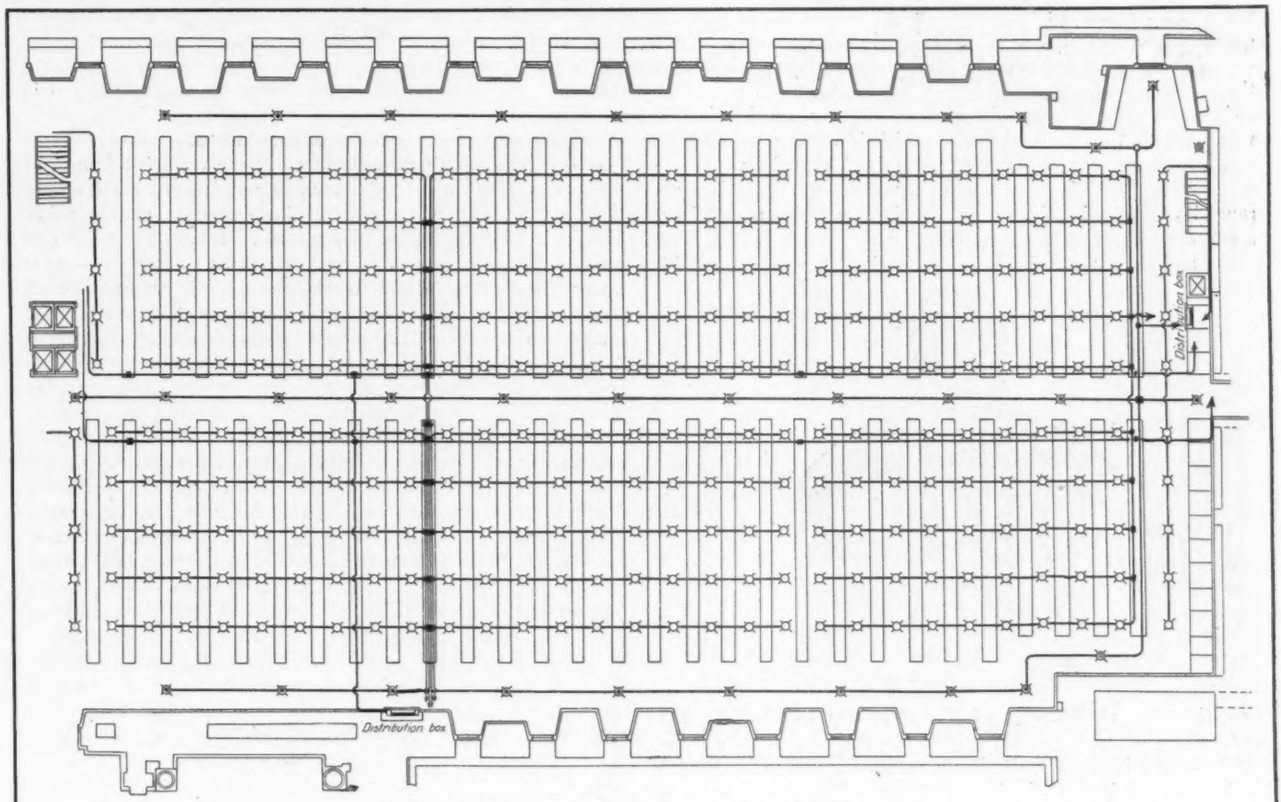
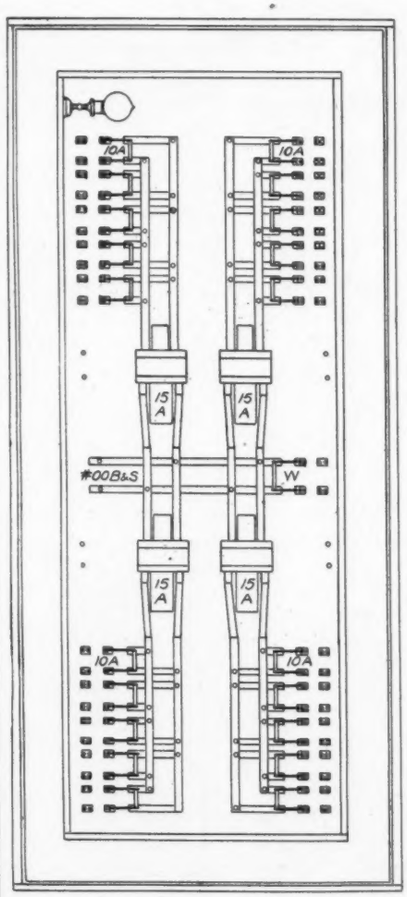
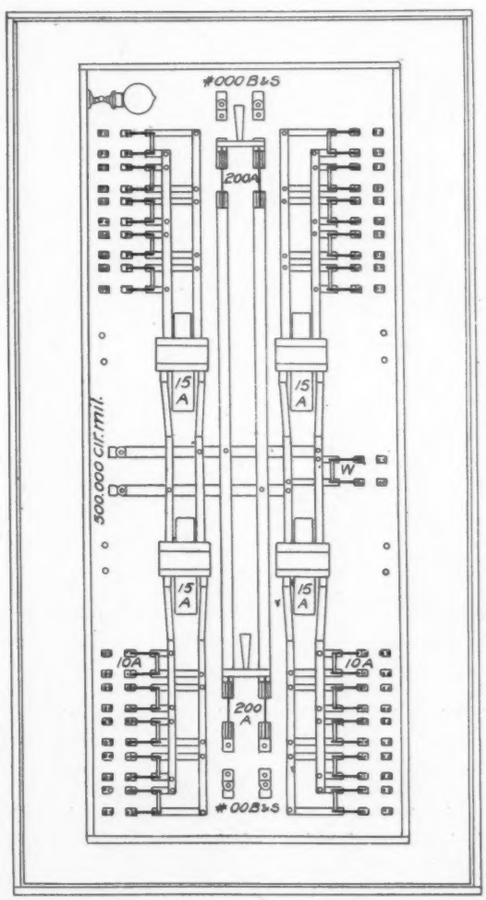


FIG. 6.—PARTIAL PLAN VIEW OF STACK ROOM WIRING CIRCUITS.





FIGS. 7 AND 8.—TYPICAL DISTRIBUTION BOXES.

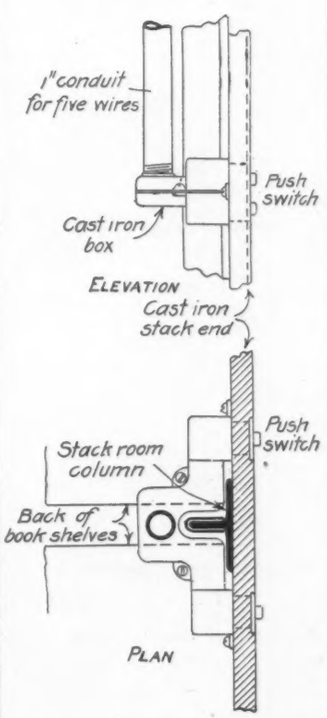


FIG. 9.—DETAIL OF BOX FOR REMOTE CONTROL PUSH POINT.

WIRING AND LIGHTING EQUIPMENT OF STACK ROOM, NEW YORK PUBLIC LIBRARY.

section of the stacks are supplied from busses controlled by the electrically-operated, remote-control switch. Each of the distribution boxes is provided with an electric lamp set inside of the cabinet, and controlled by a separate knife switch. The switches for these lamps in the cabinets are furnished with white handles, to be easily distinguishable. The distribution boxes at the center of distribution on the fourth floor are provided with fused knife switches for each of the mains, arranged as shown in Fig. 8. All distribution boxes are of iron, lined throughout with ¼-in. slate, and provided with iron trims and doors; the doors being lined with plate glass with

FIG. 10.—REFLECTOR LAMP.

provision for a directory of the circuits controlled by the switches.

The outlet boxes for the lamp receptacles are of a special design of cast iron, as indicated in Fig. 12, made as small as possible to take a special porcelain base lamp receptacle. They are spherical in form, made in two pieces held together by machine screws and tapped for screwed connections to conduit. They are of three patterns, one for straight runs, one for angles and one for ends of runs. Because of the variation in the steel construction, the conduits in the aisles run at a slightly different level from those in the stack passages, and

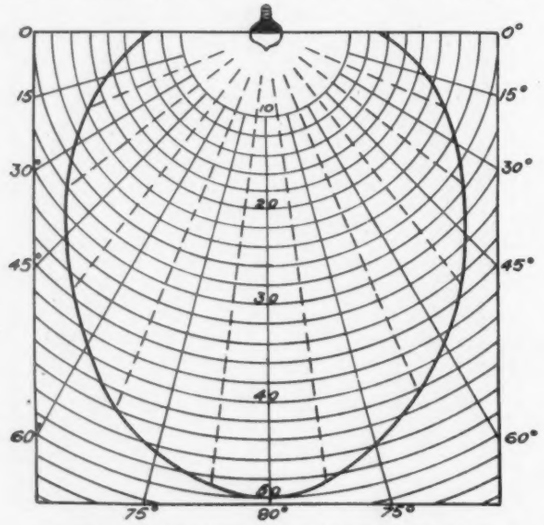


FIG. 11.—CANDLE-POWER CURVE OF REFLECTOR LAMP.

these boxes are fitted with thicker cast-iron buttons on the backs to fill out the space to the marble. All conduits entering the boxes are fitted with internal brass bushings to prevent abrasion of the wires.

The remote-control switch points in the ends of the stacks occur in pairs and, in order to fit in the perforations of the castings, are not set in gangs. Special cast-iron boxes, Fig. 9, are provided for these switches of such a design that all of the wires from one pair of switches are carried up to the main trunk conduit in a single vertical conduit run between shelves of the stacks, and taking up no book space, as shown in Fig. 9. The switches are provided with special plates and special mechanism to fit the design of the stack ends. Throughout all of the floors of the stack room there are 162 of these switches. The remote-control points at the central desk are arranged in gangs on either sides of the desks, and are set in regulation cast-iron gang switch boxes with flush plates.

In order to reduce the amount of visible conduit as much as possible, a number of the branch circuits from each distribution box are carried over in a single conduit and arranged with pull boxes opposite to each row of lamps. These pull boxes (Fig. 3) are of cast iron, designed to fit into the space under the diaphragm and to take the conduit at the different levels without bends. A main conduit is run the full length of the stack room on either side of the center aisle to accommodate all remote-control wires, and all of the remote-control points in one story which are fed from one set of busbars are wired with a common neutral, which loops through each of the switch boxes in turn. It will be seen by the typical plan that the regularity of the system of trunk conduits for the remote-control switches was upset by the vertical ventilating ducts in the book stacks on one side of the aisle. This made it necessary to move the trunk conduit away from the aisle and run longer branches from the switches. In the seven floors of the stack section there is a total of 4634 lamp outlets, representing a total of 232 kw, distributed over a floor area of 163,000 sq. ft., or approximately 1.42 watts per square foot.

The interior of the stack section, including stacks, shelves and steel work, is to be finished an egg-shell white. The con-

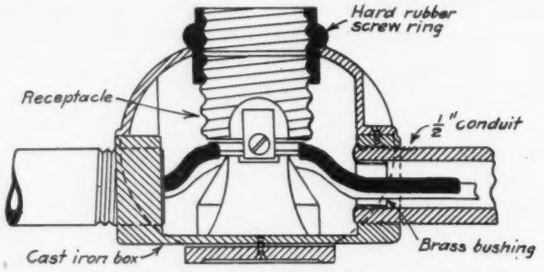


FIG. 12.—DETAIL OF LAMP OUTLET BOX.

duit work, boxes and cabinet fronts will be painted and finished with the stacks; and in order that the paint can be more easily applied and more durable, galvanized iron tubing, enameled inside, was selected.

All branch circuits consist of double-braid wire with 30 per cent para rubber insulation. Single conductors are used in all cases as the connecting of the lamp receptacles was more easily done with this than with duplex wire.

Standard ½-in. tube was used for all single branch circuits and all of the tubes in the stack spaces are supported from the steel work above by galvanized-iron pipe straps placed on either side of each outlet and held in position by machine screws tapped in the steel work. The end boxes of the runs, where the tube enters only in one side, are supported by machine screws in the back of the boxes tapped into lead plugs in the marble floor slabs. The screw holes in the steel work were punched in the field by hand punches set by template to insure alignment. There were about 19,000 of these holes to be punched and tapped through the webs of the 1½-in. angle irons. It was found that two men working with one punch could punch approximately 1100 holes per day, and the tapping, while not done with as great speed as this, could be performed very rapidly by apprentice boys.

All branch-circuit conduit was cut to measurement and threaded by machinery, and was delivered at the building ready to screw into the boxes. These were made up by accurate template to lengths of five boxes, the work being done on the bench, and were carried to the stack spaces and put up in these lengths. This system reduced the labor to a minimum and required no skilled workmen, one boy being able to make up about 240 outlets per day.

The placing and connecting up of the lamp receptacles in

the straight runs was done before the conduit was placed on the ceiling. The runs of conduit were placed on temporary supports about 4 ft. above the floor, with all boxes inverted, and in this position the wires were drawn in and the receptacles set and connected where they were easily accessible. The wire was cut of sufficient length to reach the distribution box and coiled up at the end of the run, then the whole run was lifted into place and the pipe straps applied. With the boxes in this position a single man could draw in the wires and connect about 110 receptacles per day.

By systematizing the work as described above and making all parts to template, the labor cost per outlet on the branch circuit work was very low. The total labor, with the exception of the machine work on the pipe, amounted to less than 15 cents per outlet, which includes all drilling, punching and tapping. The stack room is at the present time still in an unfinished condition, none of the marble floor slabs having been set. Figs. 1 to 4 show the work that is in place and the condition of the work at present.

A great deal of study and care were devoted to the arrangement and details of the stack room by the architects, Messrs. Carrere & Hastings, and it is to them that the city is indebted for the design. The Lord Electric Company has the contract for the electric work of the entire building, and the installation is being made from the design and under the supervision of Messrs. Pattison Brothers, consulting engineers.

The Effect of Wave Form Upon the Voltage Ratio of Transformers.

BY MORTON G. LLOYD.

The effect of wave form upon the core losses of a transformer has been determined both theoretically and experimentally by a number of observers,[1] but as far as known to the writer the effect upon the ratio of the terminal voltages has been attacked only by Rössler. He found, by using two different generators with a single transformer, that the ratio at full load might be affected as much as 1.5 per cent by a change in wave form where the effective electromotive force is kept constant.[2]

Unfortunately, Rössler's experiments were made with an improvised transformer, and the results do not apply to well-made commercial transformers, as will be shown by the results below. Moreover, the effect depends upon the characteristics of the particular transformer used, and may be in opposite senses in different transformers. Using the term "ratio" to mean the ratio of the primary effective terminal e.m.f., to the secondary effective terminal e.m.f., a step-down transformer being assumed, Rössler found that under full load a peak wave increased the ratio.

In a constant-potential transformer the ratio differs from the quotient of the primary and secondary turns on account of the leakage and of the potential drop in the windings due to their resistance. The greater these quantities, or either of them, the greater the ratio and the poorer the regulation. Bearing these facts in mind, it is easy to determine qualitatively the effect of change in wave form from theoretical considerations.

The electromotive forces induced in the primary and the secondary windings by the core flux have the same wave form, and the terminal voltages can differ from them, and the ratio can be affected, only in so far as the leakage and the ohmic drop influence the terminal voltages.

The ohmic drop is proportional to the current, and its effect will depend upon the average value of the current. If a distorted wave of current be used, such that the form factor is higher (peaked wave) than for a sine wave, then for a given effective value the resistance drop will be less than for a sine wave. The electromotive force due to leakage reactance varies approximately as the rate of change of current, and this will be greater than for a sine wave. The effect upon the ratio of the transformer will therefore depend upon whether the reactance or the resistance drop of potential predominates.

With no load on the transformer it is to be expected that any change of wave form will have a negligible effect upon the ratio. If the transformer be fully loaded with a non-inductive load, both the secondary and the primary current will have approximately the wave form of the applied electromotive force, and the changed wave form with the much larger current will be likely to affect the ratio. With a peaked wave of applied electromotive force the ratio will be increased if the leakage reactance predominate, and will be decreased if the resistance predominate.

TABLE I.

Shunt Transformer 1100-to-110 Volts, 50 Watts, Tested at 60 Cycles, 1100 Volts, 30 Per Cent of Third Harmonic.

Wave Form.	Load.	Ratio.
Sine	None	9.880
Peak	None	9.873
Sine	Full	10.070
Dimple	Full	10.078
Peak	Full	10.068

With a highly inductive load the effect of wave form should be less; with a condenser load it should be greater.

With a flat wave giving a form factor less than that for a sine, the effects will be reversed. In any case it is apparent that the leakage reactance and resistance drop may be so balanced as to make the ratio independent of the wave form. In actual transformers, then, one must expect to find some unaffected, some having the ratio increased and some having it decreased.

In order to get experimental data upon the subject, the form of wave was varied by connecting two generators in series, the two being mounted upon a single shaft and giving frequencies of 60 and 180 cycles, respectively. Each generator alone gives an approximate sine wave. One connection of the generators gives a peaked wave; by reversing the terminals of one machine this is changed into a flat or dimpled wave. The wave forms were determined by means of the oscillograph. The voltage of the high-frequency machine is expressed as a percentage of the voltage of the lower frequency.

TABLE II.

Shunt Transformer 480-to-120 Volts, 500 Watts, Tested at 60 Cycles, 480 Volts, 17 Per Cent of Third Harmonic.

Wave Form.	Load.	Ratio.
Sine	None	4.010
Peak	None	4.007
Flat	None	4.012
Flat	Full	4.161
Peak	Full	4.159
Sine	Full	4.160

The ratio was measured by a differential dynamometer voltmeter designed for the purpose by Dr. E. B. Rosa. This instrument will be described in detail in a forthcoming article on the subject in the *Bulletin of the Bureau of Standards*. I content myself here with giving some of the results. The transformers whose tests are recorded in Tables I and II, were made by the General Electric Company. It will be noticed that their ratios change less than one-tenth of 1 per cent at both full load and no load, with wave forms very much distorted. The small change observed is in the opposite direction from that observed by Rössler; that is, a peaked wave in this case lowers the ratio, indicating small leakage reactance in both transformers. The resistance is the determining factor, and the leakage reactance is only apparent in decreasing the effect at full load. All the

TABLE III.

Special Transformer 60-to-60 Volts, Tested at 60 Cycles, 60 Volts, 24 Per Cent of Third Harmonic.

Wave Form.	Load.	Ratio.
Sine	None	1.205
Peak	None	1.200
Flat	None	1.230
Flat	1.5 ampere	2.605
Peak	1.5 ampere	2.630
Sine	1.5 ampere	2.548

[1] C. P. Steinmetz, *Alternating-Current Phenomena*, Chap. 22; G. Rössler, *Electrician*, 36, p. 124, 1895; M. G. Lloyd, *Bull. Bureau Standards*, 4, p. 477, 1908; and others.

[2] G. Rössler, l. c., p. 151.

commercial transformers tested by the author have given similar results.

To make the effect of leakage reactance apparent, a transformer was improvised by winding two coils upon opposite sides of a core of laminated iron. The results, which are given in Table III, show an increased ratio with peaked wave at full load. The resistance drop here was large also, so that at no load it predominates. The fact that the ratio was more than doubled by loading shows that the conditions here were very much exaggerated.

Rössler's results indicate that the leakage in the transformer used by him was large, and this is explained by the fact that the coils were wound side by side and not one over the other. His results (as regards ratio) do not apply to good transformers, where the effect will usually be in the opposite direction and negligible in amount.

The writer also made some measurements upon the ratio of the currents in a series transformer, as affected by wave form. In this case a portable dynamometer ammeter was connected in the secondary circuit, and the current was adjusted until its needle coincided with a division. The error here was not greater than 0.05 per cent. In the primary circuit a mirror dynamometer was included, its reading being taken simultaneously. The wave form was varied in the manner already described. The results are given in Table IV.

The effect is seen to be inappreciable except with a large component of harmonic, and would be negligible for all practical purposes unless the component of harmonic exceed half the value of the fundamental.

To exclude the possibility of the observed change being due to changes in the instruments and not in the transformer, the portable dynamometer was placed in series with the mirror dynamometer in the primary circuit and readings were taken with the same current in each. These showed no discrepancies beyond the error in reading for the most distorted wave.

TABLE IV.

Series Transformer 5-to-5 Amp, Tested at 60 Cycles, with a Secondary Current of 4.0 Amp.

Wave Form.	Per Cent Third Harmonic.	Per Cent Increase in Ratio from Sine Wave.
Peak	11	0.0
Flat	11	0.0
Dimple	30	0.05
Peak	30	—0.03
Dimple	30	0.07
Peak	30	—0.08
Peak	68	—0.15
Dimple	68	+0.17
Dimple	68	+0.14
Peak	68	—0.16

The Telephone Repeater.

By L. A. Lindsey.

When telephone instruments were in the early stages of their development, a slight modification in the way of improving the instruments effected a considerable increase in the range of the instruments, and from time to time, improvements were made in the circuits and instruments and the range was increased until the point was reached where the line effect became an important feature in long distance transmission. While the line effect can be remedied to a great extent by increasing the size of the wire, by inserting proper loading coils, or by otherwise improving the character of the circuit, yet the improvement cannot be carried on indefinitely.

As has been demonstrated, the e.m.f. in the primary circuit may be increased, or the transmitter or coil modified to give a greater amount of line current; this increase, however, fails to give any appreciable increase in the range of the telephone, due, doubtless, to the fact that the partial or overtones which make up the characteristic sound of the human voice are drowned out in a greater proportion by the more sinuous sound waves that may be designated as "noises." An illustration is afforded by public speakers; some have a careless, smooth manner of pronunciation, and while they can be heard for a considerable distance, they are not well understood even at close range, while others have a sharp, clear-out pronunciation, and such a speaker will be understood farther away than the former kind, but he will probably not make so much "noise."

Noise waves, which when graphically represented show a sinuous curve, are more readily taken up by a diaphragm than are the more irregularly-shaped sound waves such as represent the characteristic sounds of the human voice and make the really articulate part of human speech. This phase of the subject has been elaborately discussed by Mr. D. MacL. Therrell in an article appearing in the Electrical World of Nov. 11, 1905.

As the point was reached in the evolution of the telephone where improvement in details failed to give appreciable results, the need was felt for an instrument that would impart new energy to the almost exhausted voice-current-waves without materially affecting their shape. The telephone current being of a nature distinctly different in all respects from the telegraph current, the same or similar instruments cannot be used. The telegraph repeater is required to repeat only "makes" and "breaks" in the circuit while the telephone repeater must maintain the characteristic shape of the current-wave and strengthen it, or reproduce it on the secondary circuit. As it is presumably impracticable to arrange an instrument to operate a switch to reverse the primary and secondary circuits as the voice current comes from one or the other end of the repeated circuit, the only alternative is to construct the circuit through the repeater so as to be reversible in its arrangement.

Before an instrument can be properly designed for a particular service, all conditions must be kept in mind, and the limitations of the various phases must be duly considered. In the telephone repeater there is a current of comparatively minute proportions with a wide range in frequency and a very irregular or aperiodic form of wave shape, with the modifications due to the disturbing influences of the instruments and circuits, which current is to be reinforced and impressed on the secondary circuit in as near its original form as possible. As the voice current is modified more or less when it reaches the repeater, it is out of the question to restore the current wave to its original form, and as much as one can expect to do is to reinforce it. A repeater that will bring the current up to its original strength will not be as successful, in the broad sense of the term, as the commercial telegraph repeater, which latter is required merely to produce interruptions in the secondary circuit similar to those in the primary.

With this view of the subject the writer is convinced that the solution of the repeater problem, from a practical standpoint, cannot be attained, but it can be approached as a limit, so that the nearest approach will necessarily be the best solution.

Having considered the nature of the current to be reproduced it is well to turn to the mechanical side of the problem. According to the theory of the conservation of energy, one cannot expect to get something for nothing, or to get more energy out of the voice current than is represented by it in its almost spent condition; as there is such a minute amount of energy represented one must provide the most sensitive means of impressing the wave form of the original current on the new current, and of imparting to it as much of energy as possible. The common practice has been to convert the received electrical energy into mechanical motion, and apply this to the outgoing circuit by means of a variable-current transmitter, and until a better one appears this method will necessarily be followed.

In order to secure the mechanical motion corresponding to the wave form of the almost-spent voice current, owing to the wide range in the frequency, one must avoid as much as possible any mechanism which tends to respond to or pick up any one frequency or tone, and should make the operation as near aperiodic as possible. It is also necessary to construct the moving part of the instrument as light as can be made rigid, in order that

it may follow closely the wave form of the primary circuit. The moving part in turn must be connected as directly as possible to the transmitter or current-varying device. By the use of aluminum as a conductor, and the elimination of iron from the moving part either as an armature or diaphragm, this part can be built remarkably light, and a coil of aluminum wire in a magnetic field as a receiver, directly connected to the diaphragm of a sensitive carbon button is, in the opinion of the writer, the most effective design. Although aluminum wire could not be secured by the writer for experimenting, the results obtained by the use of small copper wire justify the above conclusion.

Scientists will possibly discover a substance better than carbon as a means of converting sound waves into current waves. Such a discovery will revolutionize the telephone industry, as would an instrument superior to the commercial receiver for reconverting the current waves into sound waves; but until such a substance has been found we can only turn the means we have to their best use.

Improving Power Factor by Means of Synchronous Motors.

As is well known, one of the methods available for improving the power factor of distribution circuits is the installation of synchronous motors on the lines. The advisability of installing such apparatus for the purpose of compensating for the lagging wattless currents required by the induction motors and similar devices is, however, a mooted question. In the Question Box presented on Oct. 16 before the American Street & Interurban Railway Engineering Association at Atlantic City the matter was discussed at some length. Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, claims that the instances in which it pays to install a synchronous motor for the special purpose of raising power factor are relatively few. Where a motor of relatively large size is required for use in furnishing power in connection with lines upon which it is desired to improve the power factor, the use of a synchronous motor, he says, is then advisable. It should have sufficient capacity to carry, in addition to the load to be driven, the compensating current in quadrature with its load current without the resultant armature current exceeding the current of normal full-load, and should be capable of adequate over-excitation.

Mr. M. V. Ayers, electrical engineer of the Boston & Worcester Street Railway Company, said that he did not believe it would pay to install a synchronous motor for this purpose except in very unusual cases. It would never pay to do so in the usual street-railway plant involving merely generators and rotary converters. The only case in which such a procedure would be indicated, in the opinion of Mr. Ayers, is where a plant feeds energy to many induction motors or a vast number of underloaded transformers. Even in such cases the proposed remedy would be unnecessary if the generator were properly designed for the work. If it is possible to maintain the desired voltage by over-exciting the generators, this is the better and more economical solution. Mr. Ayers said that the use of the synchronous machine is bound to involve more electrical and magnetic loss and greater complication. It is more expensive and merely forces the generator to do the work required of it.

Mr. G. R. Folds, general manager of the West Penn Railways Company, says that synchronous motors pay when used with combined light, power and railway load. For straight railway work the power factor can be taken care of by the rotary converters. The size of the synchronous motor to install will depend on how low a lagging power factor it is necessary to overcome.

Prof. George C. Shaad, of the Massachusetts Institute of Technology, expressed himself on this question as follows: Whether or not to install a synchronous motor depends entirely on the nature of the connected load, the generating and transmission system and the operating conditions. There are cases where the installation of such motors is desirable. Synchronous motors are installed for the purpose of raising the power factor on account of the improved regulation thereby obtained to reduce the kv-ampere load on the generators, lines and transformers, or to increase the watt or power component for a given kv-ampere load. On a system fully loaded, operating at a low power factor, additional load can be carried for the same apparent load on the electrical apparatus if the power factor of the load be raised. Synchronous motors should be installed for raising the power factor of the system only when a balancing of the charges against the synchronous motor and the charges against the increase in generator, transformer and line capacity to accomplish the same result, as far as operating conditions are concerned, shows in favor of the motor. Again, the synchronous motor should not be installed unless it can be properly looked after in operation, as such a motor may be operated to reduce the power factor instead of raising it. In general, it is desirable to use a synchronous motor carrying some load, as in that case the relative value of the motor capacity installed merely for the regulation of the power factor is reduced. Usually it is not advantageous to attempt to raise the power factor to unity.

There is no fixed ratio between the rated capacity of the synchronous motor and the connected load, since this depends upon: the load carried by the motor; the original power factor; the desired power factor, and the characteristics of the apparatus.

The following rule may be used to determine the rating of a synchronous motor installed for power factor regulation:

The kv-ampere load on the system without the synchronous motor is equal to the square root of the sum of the squares of the actual kilowatts as indicated by the wattmeter and the wattless component of the load in kv-amperes. If the synchronous motor is to be run idle and the power factor is to be raised to unity, then the rating of the synchronous motor in kv-amperes should be equal to the square root of the sum of the squares of the load in kv-amperes and the motor losses in kilowatts. The losses in the motor should be added to the original load to obtain the new load on the transmission line of step-down transformers.

If the motor is to be loaded, then its load in kilowatts should be added to the motor losses in determining its rated output. If the power factor is not raised to unity, then the wattless component to be used in determining the motor rating by the above method is the difference between the wattless component of the load at the lower power factor and the wattless component of the load at the new power factor.

To show the improvement in regulation due to raising the power factor the following figures are given:

A three-phase system operating at 60 cycles and delivering 9000 kw over a line 22 miles in length at 40,000 volts, assuming wires 0.38 in. in diameter and spaced 40 in. apart at the corners of a triangle, reactance of step-up and step-down transformers 3 per cent, will require an equivalent voltage of approximately 46,000 at the generator for a load of unity power factor. For power factors of 95 per cent, 90 per cent, 80 per cent, and 60 per cent the generator voltages would be 49,100, 50,300, 52,400 and 54,300, respectively.

Assume a load of 1600 kw at a power factor of 80 per cent. The load in kv-amperes will be 2000 kw.

$$2000 = \sqrt{1600^2 + (\text{wattless component})^2}$$

$$\text{Wattless component} = 1200 \text{ kv-amp.}$$

If a synchronous motor is to be installed to bring the power factor of this system up to unity and the motor is to be run light, then, assuming its losses to be 120 kw, its rating should be:

$$\text{Rating of motor in kv-amp} = \sqrt{1200^2 + 1200^2} = 1206 \text{ kv-amp.}$$

By assuming the mechanical loads of 100, 300, 500, 750 and 1000 kw on the motor and taking the motor losses in about the same proportion as above, the requiring rating of the motor is found to be 1221, 1282, 1373, 1527 and 1718, respectively.

In case it were desired to raise the power factor to 95 per

cent only, the value to be used for the wattless component in obtaining the synchronous motor rating would be obtained as follows:

Wattless component when operating at 80 per cent power factor..1200 kv-amp
Wattless component when operating at 95 per cent power factor.. 526 "
Wattless component to be used in determining motor rating..... 674 "

Experience in Steam-Turbine Operation.

One of the most interesting reports presented at the Atlantic City street railway convention was that of the committee on power generation, consisting of Messrs. G. H. Kelsay, chairman, William Roberts, G. A. Harvey, C. F. Bancroft, G. B. Dusinberre and R. A. Dyer, Jr. The subjects considered are the practical operation of the steam turbine, steam meters and flue-gas analyzers.

Thirty replies were received to queries relating to experience in the practical operation of steam turbines. The period of observation extended in some cases to over four years, the average being two years and three months, and covered experience with reciprocating, direct-connected and belt-driven engines and ranging from 2700 kw down to 200 kw, and with turbines from 5000 kw down to 75 kw.

In discussing the data received the committee states that the reports show, with little evidence to the contrary, that the cost of repairs and maintenance and labor cost of operation is favorable to the turbine plant. Such replies as do not confirm this were from one or two cases where apparently the turbine has been operated under some adverse conditions. The economy of labor cost of operation of the turbine over the engine, is hardly apparent on plants of less than 1000 kw, but on larger plants it seems to be an important factor. In one plant of good size this was given as 0.059 cent per kw-hour for turbines and 0.108 cent for engines. The same plant gave cost of repairs and maintenance as 0.0303 cent for turbines and 0.0407 cent for engines. These comparisons were made where both engines and turbines were of about the same size. As these were, however, the only exact figures elicited, they cannot safely be assumed as typical.

The difference between turbine plant and reciprocating-engine plant in fuel consumption per kw-hour, under like condition of load, has not shown the turbine to possess such a decided advantage. Replies to questions on this subject are more nearly equally divided, but from a number of companies no reply was obtained on account of lack of data. However, the evidence seems to be favorable to the turbine.

Twenty out of 27 replies imply that the turbine is equal to or preferable to the reciprocating engine on the score of reliability, while but five prefer reciprocating engines as to this point; two replies indicate insufficient length of time to form an opinion. For operation under varying steam pressure, the replies are not so decidedly favorable to the turbine, there being five of the 24 replies favoring the reciprocating engine.

Even though the turbine is a much simpler and possibly more reliable unit than the reciprocating type, the importance of high vacuum and superheat necessary to its most economical operation necessarily adds more complicated and less reliable equipment to both boiler and engine room. It is probably on account of this essential auxiliary equipment that a great many replies from users of the turbine were not more favorable to the turbine.

Steam-driven auxiliary equipment is preferred under most all circumstances, and especially so where the exhaust is needed to heat the feed water. In a few replies, engineers preferred electrically-driven exciter units and circulating pumps. The condensers preferred by companies replying were necessarily of various types, as local conditions and quality and quantity of water available govern their choice. The vacuum obtained by railway companies operating turbines varies from 26 in. to 28¾ in., and one company reporting as high as 29 in., and another at 29¼ in. From 31 replies only nine companies reported that they do not superheat steam.

The questions, "Do you consider it equally necessary for turbine and reciprocating engines to be heated up before starting?" and "Which has the advantage of time?" were asked. It was one of the earlier claims that a turbine, on account of its simplicity, could be started much sooner than the reciprocating engine, but replies to the above question do not prove this, as practically all users of turbines reporting regard it equally necessary to heat the turbine, and a few report favorably to the engine on account of the complicated auxiliary equipment of the turbine.

Replies to the questions, "Do you inspect your turbines systematically by opening?" and "To what extent and at what intervals?" were with but three exceptions that they are inspected systematically, but as to the extent of inspection there is a variety of practice. Some inspect externally once each day, while some companies inspect thoroughly, externally and internally, once every three or four months; the internal inspection being for the purpose of examining blade clearance and remove any scale formation.

At one time there was a feeling in some quarters that the erosion of turbine blades and buckets might be a material factor in the maintenance and also affect the economy, but if the experience of those who replied on these points can be considered as representative of what may be expected, there seems to be little cause for uneasiness on this score. Those who have had turbines in use longest report no erosion. It seems necessary, however, to provide proper means for separating entrained moisture from the steam in all cases. One possibility is pointed out in two replies, namely, the formation of scale on the blades sufficient to affect the economy. It would be interesting to know if this may not have come under the observation of others and what steps might be taken to correct it.

The replies on the question of overload indicate a wide range of practice, it being quite common to take full advantage of the overload possibilities of the units for peak loads as being more economical than starting additional units.

Discussions of Papers at the I. E. S. Convention.

The second annual convention at Philadelphia of the Illuminating Engineering Society, the final session of which was held on Tuesday afternoon, Oct. 6, surpassed all expectations both as to attendance and concerning the interest displayed in the papers and discussions. The total registration reached the even 400 mark, 242 of those registering being members of the society. The result of the success of the convention is being felt already in an increase in the membership, especially of the Philadelphia section. All of the convention committees worked with effective enthusiasm and nothing was allowed to appear to mar the pleasure of the members and guests. To the committees on arrangements, entertainments and exhibits, of which the chairmen were Messrs. George Ross Green, Robert J. Rolston and J. B Klumpp, especial credit is due for the profitable employment of every moment of the time from the opening of the convention to its close. The entertainments provided for the guests were of unusual excellence and thoroughly appropriate. An instructive exhibit was made of the Ives colorimeter, the Sharp-Millar spherical photometer and numerous gas-lighting conveniences that were described in three of the convention papers. In addition there were shown various high-efficiency gas and electric lamps, artistic lighting fixtures, convenient photometric and calculating devices, color-comparison lighting equipments and lamps of all periods from the time when pine knots were used until the present.

Our issue for last week contained abstracts of all of the papers presented at the convention. Below are given accounts of the discussions which followed the reading of the papers not covered in our last week's issue:

The paper by Mr. T. J. Litle, Jr., entitled "Modern Gas Lighting Conveniences," brought forth an interesting discussion concerning the defects in various gas ignition schemes. Dr. Clayton H. Sharp stated that a considerable portion of the

failures in electric ignition schemes can be attributed to defective insulation. The insulation ordinarily employed, being of the type used with bell wiring, is entirely inadequate for high-tension electric ignition. He asked for information concerning the danger which may attend the use of pilot flames in locations where the flames may accidentally become extinguished.

Mr. Walton Forstall said that the amount of gas consumed by a pilot flame is so small that when the flame is extinguished no damage can be done, even though extra precautions may have been taken to prevent ventilation in a room. The ordinary crevices around the doors and windows afford a sufficient circulation of air to overcome the effect of any gas escaping from a leaking burner or extinguished pilot flame.

A question by Mr. V. R. Lansingh as to the use of multiple pilot flames brought forth the information that in a cluster gas lamp provision is made for controlling each lamp and its pilot flame independently of each of the other lamps, so that when one desires to use less than the full number of lamps in a cluster it is not necessary for the pilot flames of all lamps to be used simultaneously. The pneumatic pilot igniters have been developed to such a point that the operating mechanism can be placed as much as 20 ft. from the lamp. Moreover, as many as six lamps can be ignited simultaneously by means of a single mechanism; however, in the latter case the distance to the individual lamps must be decreased somewhat.

In reply to questions by Mr. F. N. Morton and Mr. C. W. Hare, Mr. Litle stated that considerable experimental work is being conducted in connection with the production of self-igniters of the platinum-sponge type. These igniters operate satisfactorily for a short time, but subsequently deteriorate rapidly. The pneumatic ignition schemes have proven thoroughly satisfactory, especially when the pump is built with a cork plunger. The difficulties encountered with the electric igniters are overcome when the spark gaps at the various lamps are placed in series and the outgoing and return circuits are widely separated and mounted on porcelain insulators. Use is ordinarily made of a No. 18 B & S gage bare copper wire. This wire is practically invisible when suspended from lamps mounted on ceiling fixtures.

The discussion of the paper by Dr. A. H. Elliott, entitled "Illuminating Value of Petroleum Oils," was opened by Mr. N. W. Gifford, who remarked that the kerosene lamp has been in use for considerable time as a working standard of candle power. Mr. C. O. Bond drew attention to the disadvantages which may arise from an incrustation forming upon the wick of the lamp after it has been in use for some time. He expressed the opinion that, although the candle power may remain fairly constant for several hours, the change would probably be enormous over a long period, such as 24 hours, and that the lamp is somewhat erratic in behavior.

Dr. E. P. Hyde said that it is unnecessary to obtain constancy over a period longer than 10 hours. As a matter of fact, in practical photometry it is customary to check the working standard frequently with a standard known to have remained constant throughout the observation period.

In reply to a question by Mr. R. C. Ware as to the use of a non-combustible wick, Dr. Elliott stated that such wicks have been employed, but that they possess certain disadvantages due to their becoming hardened. The common cotton wick hardens somewhat in service, and it is customary to discard them after they have been in use for a short time. He said that when a proper quality of clear oil is used no incrustation takes place.

The paper by Mr. H. Thurston Owens on "Fixtures and Illuminants Used in Street Lighting" served to emphasize the lack of proper development in the street lighting in this country. Mr. C. O. Bond said that a considerable portion of the light given forth by street lamps is wasted by being directed toward the houses rather than on the streets. Schemes should be employed for redirecting the light which is at present useless into useful directions. Mr. V. R. Lansingh stated that there are available at the present time street lighting fixtures which afford a non-uniform distribution of light, such as would comply with the requirements indicated by Mr. Bond.

Mr. T. J. Litle, Jr., remarked that a scheme involving the non-uniform distribution of light is frequently employed with gas lamps.

Mr. J. E. Woodwell stated that excellent results are obtained when use is made of opal globes for minimizing the intrinsic brightness from street lamps, especially in certain directions.

The paper by Mr. James R. Strong on "Construction Difficulties in Installation Work" was discussed by Messrs. H. Calvert, Walton Forstall, C. W. Ware, J. E. Woodwell and W. T. Dyre and by the author.

Mr. Strong remarked that in designing the lighting circuits of a residence it is essential to take into account the fact that the occupant of a bedroom will place the furniture in every conceivable combination, even to the extent of placing a bed across the doorway. It is necessary, therefore, to place outlets in a large number of locations throughout the room. The outlets should be arranged in such a way that, quite independent of the position of the mirror, the light from the lamp will fall upon the face of the person using the mirror. Similar conditions arise in office buildings. Although it is permissible to place outlets along the inside walls, it is usually preferable to arrange them along the ceiling, proper recognition being had of the relative location of the numerous windows, so that when the building is occupied by different tenants the lighting circuits will still be available for use without change in the location of the outlets.

In introducing the discussion of the paper by Mr. Emile G. Perrot, entitled "Architecture of Illumination," Dr. Bell expressed his pleasure at the spirit of co-operation displayed by architects and illuminating engineers.

Mr. A. J. Marshall remarked that it is incorrect to assume that the illuminating engineer always neglects the appearance and places an improper amount of emphasis on foot-candles and such values. As a matter of fact, practically all of those who can claim to be illuminating engineers have the proper conception of the value of appearance, both of the lamp fixtures and of the objects to be illuminated.

Mr. L. R. Hopton said that the Society should furnish in published form certain data, which will be of use to architects, as requested by Mr. Perrot.

Mr. F. J. McGuire criticised the architects, in that in many cases they recommend the use of standard fixtures in locations where only special fixtures should be employed. In order to obtain the most desirable results, the architect should consult with the illuminating engineer before the plans of the building are completed rather than afterward. In many cases a slight change in the building plans would make an enormous difference in the effectiveness of the illumination scheme.

The discussion of the paper by Mr. Leonard J. Lewinson on "The Intensity of Natural Illumination Throughout the Day" was opened by Mr. Carl Hering, who called attention particularly to certain of the values given by Mr. Lewinson relating to the maximum illumination obtained from the sun during the daytime. These values indicate that the intrinsic brightness on a white sheet of paper at midday under normal sunlight is equally as great as that of a Welsbach gas mantle when used under normal operating conditions.

Mr. J. E. Woodwell remarked that although when dealing with light obtained from artificial sources of illumination it is permissible to determine the illumination on a horizontal plane, it is desirable when specifying the illumination obtained from the sun to refer the values to the vertical plane. That is to say, under present conditions of civilization daylight obtained from immediately overhead is seldom employed for purposes of illumination within a room, but the lght which illuminates the room comes ordinarily from side windows.

Mr. Emile G. Perrot explained in detail the methods sometimes employed by architects in selecting proper location for a building upon a certain site as affected by the direction of light obtained from the sun. For example, sick rooms in hospitals should be located upon that side of the building which obtains the maximum amount of direct sunlight. Frequently the architect is unable to comply with this requirement on account of

physical surroundings of the site, but the requirements are kept in mind when designing the building, especially with reference to the location of the windows.

Mr. V. R. Lansingh called attention to the fact that observations of the variation in the intensity of daylight illumination throughout the year have previously been placed upon record and are now available in published form.

Mr. C. O. Bond discussed at some length the remarkable fact that when artificial lighting is employed an illumination of 2 foot-candles is satisfactory for reading, yet such an illumination obtained naturally at twilight or at dawn is entirely inadequate for reading purposes. Probably the degree of uniformity of illumination is of equally as much importance as is the density of light flux.

The paper by Dr. Clayton H. Sharp and Mr. Preston S. Millar, entitled "The Integrating Sphere in Industrial Photometry," was discussed by Mr. F. E. Cady, who asked concerning the amount of absorption of light by any dust which may accumulate on the diffusing surface of the sphere.

Mr. Alfred A. Wohlauer expressed the opinion that the principles involved in the integrating sphere might well be applied in determining the amount of illumination given forth by the lamps within a certain room.

In reply to a question by Mr. H. Thurston Owens, Dr. Sharp stated that by providing holes for ventilation at the bottom and top of an integrating sphere, the sphere may be used for the photometering of gas lamps as well as electric lamps. He said that the best plan for eliminating the absorption by dust is to remove the dust. In any event an integrating sphere must be calibrated before it can be used in photometry, and unless the absorption changes after calibration has been made no error will be introduced.

The paper by Dr. Herbert E. Ives on "The Ives Colorimeter in Illuminating Engineering" involked an interesting discussion concerning the relative color values of average daylight and certain types of lamps.

Mr. D. McF. Moore stated that numerous tests had shown that the color of the light given by the vapor lamp containing carbon dioxide gas differs by less than 3 per cent from that of average daylight, while the values reported by Dr. Ives show a variation of 520 per cent in the blue. A portion of this discrepancy is due to the method of making measurements, while another portion may be attributed to uncertainty as to what colors correspond to average daylight. He expressed the opinion that the carbon dioxide tube should be used as the standard apparatus for obtaining white light.

Dr. E. P. Hyde claimed that the methods used for determining the relative values of the blue, green and red rays in the light obtained from the carbon dioxide tube were not subject to great errors, because proper precautions had been taken to compare the light from the tube with that obtained from an incandescent lamp, which incandescent lamp was then taken to the Bureau of Standards so that its light might be compared with certain known values. Dr. Hyde also remarked that the excess of the value of blue in the light obtained from the carbon dioxide tube over that from an ordinary carbon arc lamp was noticeable even to the naked eye when the two lamps were viewed simultaneously.

Mr. J. E. Woodwell said that probably a portion of the seeming discrepancies in the results might be attributed to the fact that the tube which was supposed to contain pure carbon dioxide had previously contained nitrogen so that the gas may have been a composite one.

Mr. Herbert E. Ives stated that light obtained from a carbon dioxide tube is extremely satisfactory for many purposes, being soft and well diffused and obtained at a low intrinsic brilliancy. However, there is no doubt that it contains a larger percentage of blue than does the light obtained from an arc lamp or daylight.

In closing the discussion on his paper, Dr. Ives explained the method for adjusting the colorimeter when the observer has a slight defect in his eyesight. Any defect of this nature can practically be determined almost as a percentage, so that the instrument furnishes an excellent means for detecting and measuring color-blindness.

In introducing the discussion of the paper by Mr. Carl Hering, on "Calculating and Comparing Lights from Various Sources," Dr. Louis Bell remarked that recent calculations have served to show that a surface source of light may be considered a point source, so far as concerns its photometry, with an error not exceeding 1 per cent, when the photometer screen is separated from the source by a distance not less than five times the maximum linear dimension of the source.

Dr. Clayton H. Sharp said that an attempt to simplify and explain the relation between physical units should be welcomed, both by physicists and engineers. However, the paper by Mr. Hering contains certain features which cannot be considered as tending toward simplicity. He criticised the statement by the author that the spherical candle is the common unit of flux, and that the hefner is the official unit of intensity. The former unit is a new one and owes its introduction to Mr. Hering. The latter unit was adopted at the Geneva Congress, but this Congress could not be considered as official in that many of the prominent nations were not represented. Moreover, it is unnecessary to employ the hefner unit, and confusion is caused when use is made of it. Dr. Sharp also expressed his disagreement with the conclusions drawn by Mr. Hering as to the value of the light flux obtained from linear and surface sources.

Mr. Alfred A. Wohlauer said that maximum simplicity will be obtained, and satisfactory results can be insured, by defining light as flux and illumination as flux density, and employing only those units which relate to flux and to flux density; that is, the lumen and the foot-candle.

Mr. E. L. Elliott contended that the statement by Mr. Hering in reference to the spherical candle as a unit of flux is correct, because, although the lumen may be considered as the proper unit, a very great percentage of illuminating engineers are not familiar with this unit, and yet any one of them immediately understands when the spherical candle is spoken of. Moreover, of the several units of candle power that are employed at the present time, the only definite one is the hefner, and all others are referred to the hefner when a high degree of accuracy is desired. It seems proper, therefore, to refer to the hefner as the official unit of candle power, as has been done by Mr. Hering.

In reply to a question by Dr. E. P. Hyde, Mr. Hering stated that it is perfectly proper to specify intrinsic brightness of an illuminated surface in foot-candles, although the surface may possess a light absorbing characteristic. In this event, however, the value of the intrinsic brightness should relate to the flux density of the light not absorbed. In case the surface were perfectly black the absorption would be complete, and the intrinsic brightness under any degree of incident illumination would be zero.

In reply to the criticism by Dr. Sharp, Mr. Hering stated that the relations concerning the radiation from linear and surface sources referred to infinite lines and infinite surfaces, as thoroughly discussed in his paper.

In discussing the paper by Messrs. J. R. Cravath and V. R. Lansingh on "The Calculation of Illumination by the Flux of Light Method," Mr. J. S. Codman called attention to certain discrepancies between the number of watts required per square foot to produce an average of one foot-candle of illumination when 1.25-watt tungsten lamps are used, and when 2.5-watt graphitized-filament lamps are used. It might seem that the value of watts in the latter case would be exactly twice that in the former, but such is not found to be true. He asked concerning the cause for this discrepancy, which seems the more remarkable in view of the fact that when one introduces the spherical reduction factor applying to each type of the lamp the discrepancy actually increases. It is probable that a portion of the discrepancy is due to the fact that the 2.5-watt lamps had been in service for a considerable time while the 1.25-watt lamps were new.

Mr. Lansingh explained that the values given in the paper had been obtained under actual service conditions and repre-

sented the most reliable data available. They were not obtained by special tests arranged for the purpose of the paper, but were compiled from the results of tests made for other purposes. However, they may be considered as representing average conditions, and as taking into account all the factors which should be considered when designing the illumination with the types of illuminants specified. He stated his expectation hereafter to employ the expression "lumens per watt" rather than "watts per lumen," which had been used in this paper as well as in previous publications.

In discussing a paper entitled "Street Lighting with Gas in Europe," by Mr. E. N. Wrightington, Mr. Walton Forstall asked for information concerning the extent to which high-pressure gas is being used.

Dr. Louis Bell outlined certain observations made by him recently in Europe. The gas pressure has been increased gradually from a few inches up to as much as 60 in. The gas is not always transmitted directly from the station at the high pressure, but in some cases the pressure is produced locally at the different lamps. According to one method a thermo-electric motor is used for driving a compressor pump for increasing the pressure at the lamp locally.

Mr. T. J. Litle, Jr., stated that in some of the high pressure systems use is made of an automatic device for igniting the gas at a desired time each day. During the daylight hours a small pilot flame is kept burning at each lamp, the gas being transmitted at low pressure. At twilight the pressure on the street mains is greatly increased, thereby operating a mechanism which opens a valve to each lamp allowing the gas to enter the burner and to be ignited by means of the pilot flame.

In discussing the paper by Mr. L. B. Marks on the "Design of the Illumination of the New York Carnegie Library," Mr. C. O. Bond called attention to the extreme importance of providing proper illumination in libraries. It is especially desirable to obtain an illumination which will not prove injurious to eyesight. A public library is one type of public building in which the effect of illumination may prove most injurious to sight. Both schools and libraries should be well illuminated, but a difference between these two classes of buildings is found in the fact that schools are ordinarily used during the daytime and therefore depend upon natural illumination, while libraries are used at night when artificial illumination must be resorted to.

Mr. Preston S. Millar stated that the paper by Mr. Marks represents a storehouse of information for those who may hereafter be called upon to select lighting equipments for libraries, on account of the fact that the author has given complete information concerning the equipment and the illumination obtained at different points.

In reply to a question by Mr. V. R. Lansingh, Mr. Marks said that the values given as to the average foot-candles per watt per square foot were obtained by finding the average of the foot-candle readings in certain positions throughout the room, which positions were not located with a view to equal spacing. The value refers to the effective illumination in the desired locations, but cannot be considered as the average of the illumination throughout the whole area.

Dr. Louis Bell complimented the author on his liberality in presenting the valuable engineering information contained in the paper in such a manner that it becomes available for use by all illuminating engineers.

In opening the discussion to the paper by Mr. Alfred A. Wohlauer, entitled "Engineering Problems of Illumination," Mr. A. J. Marshall expressed the opinion that the qualifications of an illuminating engineer and his recognition among engineering bodies depend as much upon his ability to place proper values upon æsthetics and utility as upon his knowledge of mathematical and physical relations. Mr. F. J. McGuire entered a plea for the more hearty co-operation of the architect and the illuminating engineer in order that results of the work of these two may be more harmonious. Mr. L. R. Hopton stated that it is essential for the designer of lighting fixtures and of illuminating units to consider the appearance as well as the economy.

Mr. V. R. Lansingh explained that in order to obtain different illuminating effects it is essential to provide various forms of light distribution from the illuminants. In recognition of this requirement there have been developed reflectors of three distinctive types, giving distribution designated respectively as extensive, intensive and concentrative.

Mr. E. L. Elliott stated that uniformity of illumination is not always desirable—in many cases it is not even permissible. Generally non-uniformity of illumination is far preferable to uniformity. Thus the success of illuminating engineering can hardly be considered as depending upon the nearness with which uniformity of illumination is obtained. Moreover, although it is mathematically quite simple to assume the existence of a point source of illumination, when determining the proper shape of reflector to give a certain distribution of illumination, it is not proper to neglect the fact that the ordinary illuminant cannot be considered a point source when used in connection with a reflector of moderate size.

Dr. Louis Bell stated that experience has shown the desirability of employing graphical methods in the design of reflectors on account of the simplicity thereby secured. Thus, the methods outlined by Mr. Wohlauer are not only of theoretical interest, but they are of practical value.

The paper by Mr. J. E. Woodwell on "The Intrinsic Brightness of Lighting Sources" was discussed by Mr. D. McF. Moore, who called attention to the increasing recognition being given to the importance of intrinsic brilliancy of lighting sources. It is now well understood that the intrinsic brilliancy must be kept below certain limits. In many of the usual commercial types of illuminants the normal intrinsic brilliancy is much above the permissible value, so that enclosing globes must be employed for decreasing the brilliancy. In the vacuum-tube lamp, however, there is obtained a commercial form of illuminant whose natural intrinsic brilliancy is so low that it can be used without artificial means. On this account no loss of output is occasioned in complying with the requirement for minimum intrinsic brilliancy.

Mr. Carl Hering said that the eye demands a much higher average value of illumination when the distribution is incorrect than when it is proper. It is therefore most economical to employ the proper distribution and the weakest permissible average value of illumination.

Mr. V. R. Lansingh said that in determining the injurious effect on an illuminant on the eye it is necessary to take into account the amount of light as well as the specific brilliancy. Mr. J. E. Woodwell explained the fact mentioned by Mr. Lansingh by stating that each section of a source of illumination can be considered as sending forth to the eye a certain bombardment of particles which break down the eye cells. Thus when the number of sections is large the amount of damage to the eye is correspondingly great.

In discussing the paper by Messrs. V. R. Lansingh and T. W. Rolph on "Some Experiments on Reflectors from the Ceiling, Walls and Floor," Dr. A. S. McAllister called attention to one surprising result of the experiments which seems to show that when the ceiling and walls of a room are light the use of reflectors on the lamps is not advantageous. For example, when a reflector is used, the average resultant light is increased slightly, but the lowest value of illumination may even be decreased, so that the distribution is very much more uniform when a reflector is not used and, for certain purposes, the illumination is more satisfactory without than with reflectors. Such conditions exist in large assembly halls, but the conclusions as to the desirability of eliminating reflectors are not applicable to dining rooms or reading rooms.

Mr. Preston S. Millar expressed his appreciation of the value of the experiments recorded in the paper in that they represent the most reliable data on the subject of reflection from ceilings, walls, etc. Doubtless the paper will frequently be referred to by illuminating engineers. Mr. Millar explained by means of the light absorption equation to what extent the ceiling and walls may be expected to increase the effective illumination obtained in a room.

Mr. Alfred A. Wohlauer said that the results reported by Messrs. Lansingh and Rolph furnished excellent information

concerning the integrating-spherical-photometer effect of ceilings and walls upon the illumination produced within a room.

Mr. T. W. Rolph explained that the tests outlined in the paper were not arranged for the purpose of showing the effect of reflectors, and hence conclusions as to the advantages and disadvantages of reflectors which may be drawn from the data given in the paper should not be considered as applicable under all conditions.

In discussing the paper by Mr. F. E. Cady on "The Relation Between Candle-Power and Voltage of Different Types of Incandescent Lamps," Dr. A. S. McAllister called attention to the change in the value of the exponent expressing the variation in the candle-power with the change in voltage, as affected by the difference in the types of lamp. Practically all of this change is attributable to the variation in the temperature-resistance coefficient of the material used in the different filaments. Thus, it is to be expected that the variation of the candle-power of a carbon lamp with the change in voltage would be much greater than that of a tungsten lamp, the former having a negative temperature-resistance coefficient and the latter a positive. If the exponent had been determined for the variation of candle-power with the change in watts rather than voltage, its value would probably have been found to be approximately the same for all types of lamps at any chosen value of specific consumption.

Dr. E. P. Hyde explained the method employed by the author in determining the value of the above-mentioned coefficient. The lamp was photometered at a certain value of voltage and subsequently at a higher value. The voltage was then decreased to the former value, and later increased to the latter value. By this method the mean value for the candle power at each of these voltages was ascertained. The exponent for this range in voltage then determined by use of an exponential equation was assumed to apply to a voltage midway between the two values selected.

In reply to questions by Dr. Clayton H. Sharp and Mr. Preston S. Millar as to errors occasioned by using a constant exponent throughout the normal operating range of various types of lamps instead of the variable exponent given in the paper, Mr. Cady explained that the error would depend upon the extent of the range in voltage, and said that he had been unable to ascertain just what values of exponents are used in practice, and therefore could not express an opinion as to the errors occasioned by the ordinary method of calculation.

In reply to a question by Dr. Bell, Mr. Cady stated that the values of the exponent expressing the change in candle-power with variation in amperes or in watts had not yet been determined. The values given relate to the change in voltage, because under ordinary conditions such a value is of more practical importance than the others. However, the values for the changes in amperes and in watts will be determined from data which have already been accumulated.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Power Engineering by Central Stations.

By H. W. Hillman.

The importance of the electric-motor industry impresses one more and more as each new installation is connected. The high degree of refinement in measuring horse-power-hours consumed appeals not only to the power engineer, but to the salesman who is endeavoring to secure comparative daily costs in connection with some trial installation. At once it is apparent that steam records of horse-power-hours consumed are not available. It is equally true that little is known of the departmental costs for steam power. The use of a steam meter on individual machines for indicating cost of steam power per machine is an unheard-of proposition. An up-to-date electric-motor installation would include a curve-drawing wattmeter, maximum demand meters and watt-hour meters. Segregated costs of electric energy are thus available by departments if desired, or by machines, or daily costs, or hourly costs. Horse-power-hours under all of the above conditions may be secured with ease and accuracy.

The art of manufacturing power by electricity has made marked advancement, while the production of power by steam is still in a crude form. Electrical engineers appreciate this point. Electrical manufacturers are aware of it. Power engineers of the larger central stations use the electrical instruments and realize the weaknesses of the steam system for manufacturing power. However, such knowledge and such experiences are exceedingly limited. Factory managers in general are not yet acquainted with the marked superiority of the electric drive. Neither the large nor the small central stations yet realize the great value of the curve-drawing wattmeter.

A power engineer enthusiastically describes the interest which a factory manager has exhibited in a test of the curve-drawing wattmeter. He states that one of the charts showed the use of current at nine o'clock in the evening though the factory was operating on an eight-hour day schedule. Investigation showed that the night watchman was using the electric elevator for convenience in going from floor to floor in connection with his regular rounds. It is further admitted that the progress of production among factories can be checked by the curve-drawing wattmeter to the great help of the manufacturer. In the morning, twice at noon, and at night the chart of the curve-drawing wattmeter will indicate the power used. In other words, the chart will indicate how and when production starts and stops. The art of manufacturing power by steam has not reached this advanced point.

Instrument engineers state that the curve-drawing wattmeter acts as a detective against overloading and burning out motors. This point is well illustrated where motors are used for operating plaster grinders. Cheap labor is used for feeding the plaster into the grinders. If the superintendent's instructions are followed, by skilful feeding of the material the motors cannot be dangerously overloaded. The curve-drawing wattmeter chart will tell the story, and enable the superintendent to know exactly how the grinders are fed, and the power which the motors are consuming.

Comparatively speaking, all such power engineering is limited to a few large companies and a few large factories. It should become universal instead of limited. The time is ripe for spreading broadcast the information and valuable features of power engineering.

Illuminating engineering has now become so universally practised that the merchants and clerks among the stores talk about it. The electrical papers have given much attention to the subject of illuminating engineering. The Illuminating Engineering Society has been so active in disseminating information that central stations have been greatly benefited thereby. It is a matter of common knowledge that the campaign covering illuminating engineering has been remarkably successful, and of great benefit to the industry.

Heating engineering has shown its greatest value in the vast introduction of electric flat irons. The campaign has been so vigorous and far-reaching that people read about the electric flat irons in the monthly magazines. The central stations simply keep up their stocks and supply the demand for the class of devices admittedly desirable to their business.

Now we have reached a stage where power engineering should be vigorously pushed. It deserves even more aggressive attention. As the electric lamp and reflector concerns have

stimulated tungsten lamp sales and disseminated valuable information on illuminating engineering to merchants, so the instrument manufacturers should help stimulate the motor business among factories. Special power engineers of the electrical manufacturers should dwell more at length upon the curve-drawing instruments. More samples should be used. More illustrations should be given of their value. More articles written about them. Cleverly written articles should appear in the factory papers which will be read by production managers of factories, and the motor business will be stimulated by the exhibition of aggressiveness on the part of all interested.

In two different lectures within the past 60 days the writer has heard Dr. Steinmetz state that the electric motor business has hardly made a start as yet. The central station managers realize this point because so many factories in our midst are using steam power, which is entirely inadequate for their needs and lack even the crudest kind of instruments for determining the horse-power-hours used, and the cost of the same.

Power engineering by central stations would be greatly stimulated by the organization of a Power Engineering Society, similar to the Illuminating Engineering Society. The electric motor business would be greatly increased among the factories where steam as a motive power seems to have little reason for existence.

Central-Station Exhibits at the Electrical Show.

The annual Electrical Show held in Madison Square Garden, New York, which opened Oct. 3 and closed Oct. 14, afforded the local electric light companies opportunities to educate the public in electrical matters which they are not slow to grasp. This year, at last, the New York Edison Company, The United Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn each took large spaces, and the last two companies made very comprehensive exhibits. Each of the companies named sent letters to its customers calling attention to the show and offered them, under an arrangement with the show management, a so-called consumer's double ticket admitting two persons for the price of one. These tickets were mailed to customers requesting them and when desired the price was added to the consumer's monthly bill for electricity.

The New York Edison Company erected a magnificent reception booth in the center of the arena. No exhibits were made by the company, the booth being used for the entertainment of the company's patrons and guests. Well-executed literature prepared by the company for the occasion was distributed as well as copies of the October number of *The Edison Monthly*. In view of the fact that the show commemorates the beginning of the second 25 years of electrical service in New York City and that the company has nothing to sell but electrical energy, it was deemed best to use the space in the Garden for purely social purposes. Working exhibits of various electrical devices were everywhere about should customers desire to see apparatus demonstrated and information as to the cost and energy consumption were readily obtainable, so that the company did not suffer in comparison with the other companies who had working exhibits. The booth and surroundings were of colonial

FIG. 2.—EXHIBIT OF UNITED ELECTRIC LIGHT & POWER COMPANY.

FIG. 1.—GENERAL VIEW OF ELECTRICAL SHOW IN MADISON SQUARE GARDEN.

design, tastefully decorated with vines and autumn leaves and embellished with incandescent lamps and grape clusters.

The United Electric Light & Power Company's exhibit was located in the main aisle on the left as one entered the Garden. The booth was strikingly handsome and occupied a space 32 ft. x 51½ ft. It was brilliantly lighted by various sizes of

FIG. 3.—PART OF UNITED ELECTRIC LIGHT & POWER COMPANY'S EXHIBIT.

tungsten lamps, which were used in abundance. The space fronting the entrance was devoted to exhibits of motor applications. On the tops of the pillars surrounding the space were 250-watt tungsten lamps. Over the rear of the space was an art-glass dome 28 ft. square supported on 12 pillars, whose tops were lighted by 100-watt tungstens. The 12 arches between the pillars were lighted by 20-cp, 25-watt tungstens. Around the outside edge at the base of the dome were 104 20-cp 27½-volt tungsten lamps burning in a pendant position. On the inside of the arches supporting the art-glass dome 196 tungsten lamps of various sizes were displayed. On the smaller pillars projecting above the base of the dome 100-watt tungsten lamps were used in art-glass globes. A ball 3 ft. in diameter surmounted the dome and contained 100-watt tungsten lamps. The entire color scheme was green and gold on a white background. Hanging from the roof of the Garden above the booth

FIG. 4.—PART OF UNITED ELECTRIC LIGHT & POWER COMPANY'S EXHIBIT.

was an immense electric sign similar to the sign used last year with the exception that the words "alternating current" were flashed, the flasher being one of the working exhibits in the booth below. Among the exhibits shown in the booth were the following: On a table labeled "stunts" was a cigar lighter with two-phase ring, bell-ringing transformers and an induction motor submerged in water. A two-phase Otis elevator motor equipment with single-phase magnet control system was shown in operation as well as a complete dental office, including chair. The Fraley Vibrator Company showed a hand and a belt vibrator. Among the alternating-current motors on exhibition were

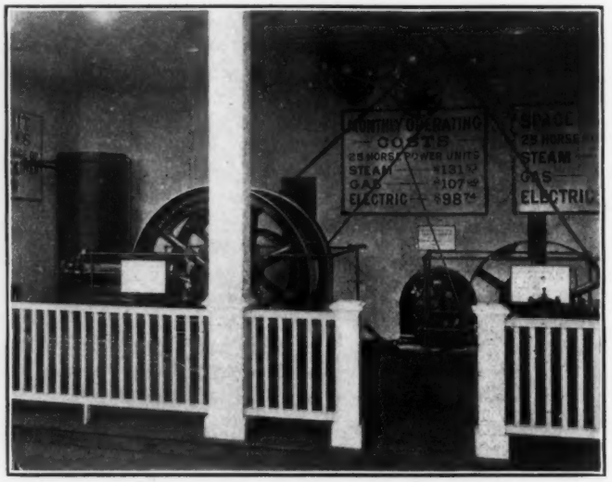


FIG. 5.—INDUSTRIAL SECTION OF BROOKLYN EDISON EXHIBIT.

Emerson electric furnace blowers, laboratory lathe outfit, two fans and a Buffalo pressure outfit. The Westinghouse Company exhibited a single-phase motor and a constant-speed motor. Messrs. Caldwell & Osterhoudt exhibited a small single-phase motor and a variable speed motor connected to a generator. The General Electric Company exhibited a single-phase, a two-phase and a two-phase back-geared motor, a buffing motor, a ventilating outfit and two small motors. The

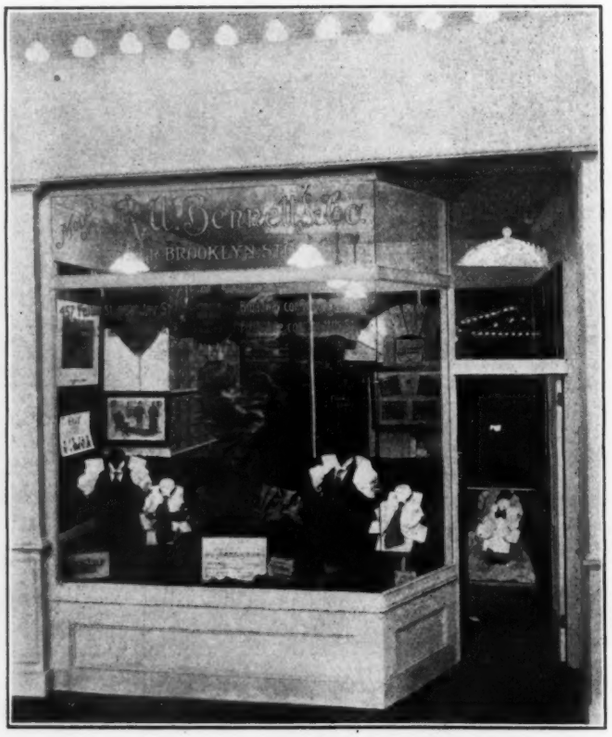


FIG. 6.—COMMERCIAL SECTION OF BROOKLYN EDISON EXHIBIT.

Cyphers Incubator Company had an interesting exhibit comprising an electrobator on a stand, two electrohens, a hover and an electroplane on top of an electrobator. The process of hatching eggs with alternating current was demonstrated effectively. Over 40 chicks were hatched in this

incubator during the first five days of the show. A mercury rectifier was shown in connection with a moving-picture machine and attracted attention. Among the electric pumps on exhibition were a beer pump and an auto tire pump of the Westinghouse company; two-phase motor driven centrifugal and reciprocating pumps of the Holland Machine Company's make, and a Watson & Stillman turbine pump. The Victor Talking Machine Company exhibited an auxetophone. Among the household appliances on view were a drop-head sewing

FIG. 7.—OFFICE SECTION OF BROOKLYN EDISON EXHIBIT.

machine operated by an Emerson motor; a Cantslip Appliance Company washing machine operated by a single-phase motor; two Westinghouse irons and two glue pots; a dining room set, coffee pot, three stoves, milk warmer, heating pad, four irons, a curling iron and a radiator all built by the Simplex Heating Company; an electric plate warmer and two electric irons of Prometheus make; a meat chopper and a coffee mill supplied by the Hobart Electric Manufacturing Company; four irons, two stoves, a corn popper, two cigar lighters, a heating pad, two luminous radiators and a cooking and baking outfit,

FIG. 8.—DOMESTIC SECTION OF BROOKLYN EDISON EXHIBIT.

all of General Electric make; a typewriter and desk, dictating machine, transcribing machine, shaving machine, etc., built by the Dictaphone Company; a new type of cash register machine printing special tickets, loaned by the National Cash Register Company; Shaler electric vulcanizer, Reynolds Dull flasher, parts of alternating-current motors, meters, etc.

THE EDISON ELECTRIC ILLUMINATING COMPANY of Brooklyn occupied the entire Fourth Avenue side of the Garden with an exhibit embracing a three-fold display of the applications of electricity for industrial, commercial and domestic uses. In the booth devoted to industrial purposes there were shown side by side a 25-hp gas engine, a 25-hp steam engine and a 25-hp motor in operation demonstrating the space saving feature of the latter, its better efficiency, ease and noiselessness of operation, and relative cost of energy and upkeep. The booth was arranged to imitate a factory and, needless to state, the superior advantages of the electric motor over the other two forms of drive were evident. The booth illustrating the commercial application of electricity was arranged in the form of a haberdashery with show window display, etc. To add to the interest of this display the window was redecked every day. The store and window were illuminated by four 100-watt tungsten lamps and cards announced that the cost of equipping a store like the one shown, excluding the cost of the lamps and fixtures, was $30 and that the monthly bills for electrical energy with the lamps burning three hours a night is approximately $3.75. This exhibit was a very practical one in that it showed exactly what can be done for a certain amount of money in equipping and lighting a store with electricity. Adjoining the commercial exhibit the Edison Company had offices for its agents, etc., where contracts could be signed. In the domestic section eight women attired in pink demonstrated the various electric household appliances. These included a chafing dish, dining-room outfit consisting of chafing dish, tea kettle, coffee percolator, stoves, disk heaters with utensils to fit such as kettles, sauce pans, cereal cookers, etc.; coffee percolators and urns, plate warmer for table use, oven-type plate warmer, range with utensils to fit, heating pads, curling iron heaters, oven, traveler's stove with cup to fit, broilers and grid iron, waffle iron, frying kettle for crullers, oysters, etc., immersion coils for heating water, barber's urn and other water urns, sterilizers, glue pot, sealing wax pot, soldering coppers with regulator stand, cord supporters for laundry irons, foot warmer, radiator, water cup, all styles of flat irons for laundry, tailor, hatter and domestic use, vibrators, hair dryers, buffing lathe and dental laboratory lathe, nursery milk warmers, washing machine and wringer, clothes dryer, coffee mill, vacuum cleaners, automatic kitchen outfit which ground coffee, peeled vegetables, mixed bread and cake doughs, froze ice cream, chopped beef, whipped cream, made butter, etc.; refrigerator outfit, cigar lighters, lamps, sewing-machine motors, etc. Inasmuch as all these devices were shown in operation, the booth was naturally crowded at all times. Above the exhibit was an electric sign with the word "Brooklyn" in letters 12 ft. high. The sign was 93 ft. long and contained 1000 lamps. Each letter was flashed separately by a Dull flasher which formed part of the working exhibit in the offices of the company in the booth below. In the office section containing the flasher various motors and motor starters were also shown in operation.

INTERIOR WIRING AND ILLUMINATION

Wiring and Equipping a Large Commercial Building.

BY J. S. WEBSTER.

The building erected for the Minneapolis branch of Butler Brothers occupies a ground area of 165 ft. x 330 ft. The building varies in height, half being nine stories high and the other half 10 stories. With the area under the sidewalk the floor space is over 528,000 sq. ft., and the building is equivalent to 10 eight-story buildings 60 ft. x 100 ft. Most of the energy for the lamps and motors is supplied over a 44-mile transmission line, transformers stepping down the voltage to 2200 and 220, the latter for a three-wire system. The watt-hour meters are connected to the incoming high-voltage lines. Direct current for motors is generated by two 100-kw, 220-volt, three-wire gen-

erators of Westinghouse manufacture, the generators being coupled to two induction motors operating from a 2200-volt, three-phase circuit. Alternating current is used chiefly for lamp circuits. In addition to the energy received from the equipment mentioned, connection is also made with 220-volt, three-wire mains from a combined steam, rotary and storage battery substation not far from the building.

Standard switchboard panels are installed and a meter panel with main switches is provided for the lamp and motor circuits so that by the addition of watt-hour meters at any future time the energy taken by each circuit may be ascertained. The building was originally equipped with about 3500 incandescent lamps, 87 arc lamps, 10 Otis direct-current elevator motors rated at 40 hp each, one 15-hp and over half a dozen smaller motors of from ¼-hp to 7½-hp rating. Over 32 miles of wire and cable were required in wiring the building, some feeders of 1,900,000 circ. mils running from the basement to the top floor. When the building was erected the tenants were too skeptical about tantalum and tungsten lamps to allow of their installation and insisted that enclosed arc lamps only could be used for lighting the shipping and packing rooms, and that 100-watt Gem lamps be used for lighting the offices and sample rooms. The main office is 165 ft. square and has about 110 pendant and 250 desk fixtures, while the sample rooms occupy the entire top floor and are equipped with about 220 pendant fixtures consisting of Hubbell pull sockets and long chains.

Each arc lamp has since been displaced by a 100-watt tungsten lamp, and as each arc lamp was on an independent circuit the building has the uncommon feature of a circuit for each tungsten displacing an arc. The main office is also lighted by tungsten lamps, and these new lamps will be used in the sample rooms as soon as the Gem lamps are burned out. Many three- to six-lamp clusters will very likely have tantalum or tungsten lamps in the near future.

As no reduction was offered by the insurance companies for conduit wiring and the city ordinance permitting knob-and-tube work, most of the wiring is of this class, conduit being used in the main office and sample rooms. The feeds to the latter rooms are run open on the ceiling below and conduit is run up the side of a post near the first outlet and a snap switch placed on the side of the post for the circuit. Circuits for the desk fixtures are also run on the ceiling below and conduit run up through the floor, terminating in a Benco socket and Hubbell plug with extension to desk portable. Condulets were used at the conduit terminals.

The various conduit runs were at first grounded to the sprinkler system, care being exercised to ground to a pipe of ample size in each case. The sprinkler contractors, however, made strong objection to this, and although no basis for serious objection was given by any of the numerous engineers called into consultation, the sprinkler contractors finally won their point, and the wiring contractor was required to provide independent grounds.

The building is mostly of timber or mill construction, but where concrete is used wooden strips were tacked to the false work before the concrete was poured, providing adequate support for the wiring without the necessity of drilling. Panel boards in a building of such size are of considerable importance, both from the standpoint of first cost and of maintenance, there being 27 steel lighting cabinets, and most of these having provision for from 18 to 36 circuits, while some provide for 48 circuits. Some extras were provided in nearly every cabinet. One cabinet was generally located in the center of each half of the building, the rooms being 165 ft. square, and the cut-outs are arranged in three tiers, each tier being controlled by a triple-pole knife switch. One switch controls the central portion, one the alley-side, and another the street-side of the room. This saves a great deal of wear and rough usage of the circuit switches. Paiste panel cut-outs, three to two-wire, are mounted upon iron bridges, providing space for circuit wires underneath. From the top of cabinets from three to 10 1-in. conduits run to a distributing box about 4 ft. long on the ceiling, and Federal bushings are used where the wires pass through.

On account of the great area and large number of circuits a blue-print was provided for each cabinet, showing the location of each circuit, and the switches on the panel cut-outs were numbered for each circuit. The cost of the wiring, switchboard, cabinets, etc., for the distributing system was under $15,000, and the installation was made in about six weeks, the minimum crew being about 35 men. Material was unloaded from cars inside the building, the track accommodating 8 to 10 cars. The calculations and preliminary sketches for laying out this work filled over 300 6-in. x 9-in. pages of scratch paper, and this became a veritable book of reference when preparing final plans and specifications, checking against bids and figuring on cost of changes or extras.

Where conditions make it desirable to control all circuits from one point in such large rooms the circuits are very long in some cases, even over 100 ft. to the first outlet. In such cases it would be an improvement over present methods to run three wires for two circuits, grounding the neutral, and using one double-pole switch and two 220-volt enclosed fuses for two circuits.

During the erection of this building considerable night work was done, and over 80 arcs and some incandescent lamps were used, besides electric hoists, boring machines, etc. Wiring for the temporary lighting had to be planned to facilitate changing the location of arcs about every three days, so a three-wire circuit was run for the lamps on each half of the end of the building where night work was done, No. 8 and No. 10 weatherproof wire being used. These wires were run as near the outside of the building as possible, usually within 16 ft. or 20 ft. Clips for enclosed fuses were mounted on fiber blocks and wires several inches long provided to tap the neutral and one outside wire for each arc. No. 16 duplex weatherproof wire was run to the base and up each post to the arc lamp on a bracket. Where long brackets were used a snap switch was placed on the side of the post. When a lamp was to be moved it was taken off the bracket, the hinged arm let down, and the duplex wire disconnected with the fuse block attached and coiled up at the base of the post till the arc lamp was ready for connection at some new location. Excess length of duplex wire was coiled near the fuses and the feeders left in one location for three stories. The energy for the lamps and motors used during the erection of the building cost from $50 to $400 per month, although heavy hoisting was done by steam hoists.

New Telephone Patents.

SWITCHBOARD CIRCUITS.

Mr. T. W. Gardner, of Nashville, has invented a three-wire common battery circuit. Electricity is fed to the line through the double windings of a line relay which serves as a retardation coil. There is a single contact cut-off relay associated with the third wire circuit. When a call is made the line relay closes the line lamp circuit. This lamp circuit is opened at the cut-off relay when the operator responds. The line relay is not cut-off, no talking current being supplied from the cord circuit. The supervisory lamps are connected to the battery and the plug sleeves, and form part of the cut-off relay operating circuit. They do not light in response to the normal current as the resistance of the cut-off relay is too high. When the line relay is de-energized, however, its back contact short circuits the cut-off relay winding and the lamps light.

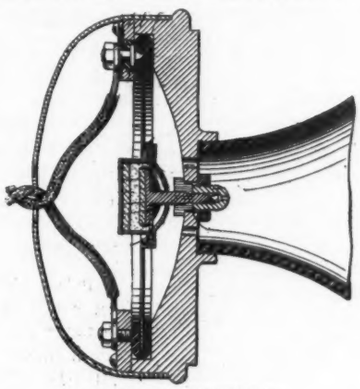
Mr. W. H. Dean has obtained patents for two two-wire type circuits, these patents being assigned to the Kellogg Switchboard & Supply Company. Both provide simplified signal circuits. In one, each subscriber's line has its own repeating coil relay. The line side connected to the battery and the ground is the operating side. On the secondary side, the windings are used in the signal circuit in differential relation only. From the middle joint of this side, a resistance coil is connected to the ground. When the relay is energized, electricity from the battery flows through the line lamp to the relay and thence through the resistance coil and the lamp glows; when a plug is inserted there is formed a shunt circuit which includes the supervisory lamp,

connected through equal retardation coils to both cord strands thence through both sides of the jack and both secondary windings of the repeating coil to the ground through the resistance coil. Each lamp, that is, the line and supervisory, shunts the other. When the line relay opens the line lamp circuit, the supervisory lamp glows to full brilliancy.

The second system is a modification of the Dunbar circuit. In the cord circuit, a front and back contact supervisory relay is used on the tip side, while the supervisory lamp is included in the ring side. The relay short circuits or feeds electricity from the battery to the lamp, as the case requires.

NEW APPARATUS.

The cut shows in cross-section a new transmitter, the invention of Mr. J. T. Curtis, of Bement, Ill. A circular depression is made at the middle of the diaphragm. This depression has at its periphery a flat bottom, but the middle portion is dished. The



CURTIS TRANSMITTER.

flat part forms a seat for the mica diaphragm and the base piece of the button. The attachment of the spindle to the diaphragm is made as shown with an adjustment so that the tension on the diaphragm is capable of variation.

Mr. W. R. Daniels, of New York City, has patented an intensifier for telephone receivers. It is in the form of a rest in which the receiver may be placed, ear-cap down. In the bottom of the rest is a tube capped to fit the face of the ear-cap, the tube itself registering with the opening of the receiver. Rubber tubes with a twin ear-piece extends to the ears of the user.

In country districts bells are often used in lieu of switchboard annunciators. Mr. C. Mahler, of New York City, has designed a special bell for this purpose, the object being to obtain compactness. Single gongs are mounted with their base planes perpendicular to the switchboard face. Behind and within the switchboard are the actuating coils, the bell clappers from which project forward beneath the gongs in a manner to tap the edges.

SERVICE METER.

A service meter for telephones is the subject of a patent granted to Mr. N. M. Holland, of Brookline, Mass. The meter is of the automatic type, requiring two steps for operation. It is arranged to be placed at the subscriber's premises. The apparatus is so arranged that a reversal of current takes place upon the response of the distant party, which reversal causes the count at the meter, the meter having first been set by the origination of the call.

PARTY LINE SYSTEMS.

A switch device for party line systems has been patented by Mr. C. Truitt, of Moscow, Ohio. It is associated with the hook switch-lever. One side of the party line is looped through the switch at each station, and the line may be cut off either way at will so as to leave the unused section free. The switch is a spring device; when displaced in either direction it will be blocked by the rising hook switch, but it will be again released when the receiver is replaced.

NEW TELEPHONE SETS.

The telephone desk stand set has taken a standard form which is not far in general outline from that of the standard telephone receiver. Following this design still further, Mr. S. S. Sonneborn, of New York City, has used the stand to encase a receiver, having a solid cap from which are tubes of rubber are brought out to ear caps. The latter are of sufficient weight to operate the switch hook.

For some purposes the telephone receiver and transmitter are contained in a single small casing adapted to be shifted from mouth to ear. It is evident that if two different apertures in the casing are required for listening and talking confusion may arise. To avoid this, Mr. F. W. Wood, of Newport News, Va., has patented an instrument with two concentric mouthpieces, the one connecting with the receiver and the second with the transmitter.

Mr. John A. Hulit, of Topeka, Kan., has improved his party line system. The apparatus is designed to operate on telegraph line and must therefore not be affected by the Morse dots and dashes. It is arranged to respond only to long dashes closely spaced, failing either on long spaces or short impulses.

LETTERS TO THE EDITORS.

Tungsten Lamps vs. Gas Mantles.

To the Editors of Electrical World:

SIRS:—We note your reproduction on page 682 of the issue of September 26, of our advertisement which appeared in the Boston newspapers. We also note the inference drawn in the last sentence, in which you state that "the argument of cheaper cost of gas illumination has ceased to be tenable."

We would emphasize the fact that even disregarding the greater quantity of light given by our new inverted burner, and also disregarding the much greater cost of the renewals of tungsten lamps, gas at 80 cents per thousand cubic feet is cheaper than electricity at 3 cents per kilowatt-hour.

We feel that the quality of light given by our new lamp is so much superior to that of electricity that economy is a secondary consideration, although there is very substantial saving when it is substituted for an equal electrical unit.

Since your previous criticism gives an erroneous impression, perhaps you may be willing to insert this correction.

W. W. CUMMINGS,
For the Secretary of the
BOSTON, MASS. *Boston Consolidated Gas Company.*

[We presume that our correspondent bases his claim for superior efficiency on the rating of the gas mantle at 20 candles per cubic foot of gas per hour, which pleasant fiction recalls the old-time full-arc rating of 2000 candle-power. Moreover, we venture to surmise that in his calculations he has ignored the somewhat important facts that the tungsten lamp retains its initial candle-power practically unimpaired until the end, while the gas mantle rapidly changes its greenish glare to a ghastly glimmer.—EDS.]

Efficiencies of Nernst Lamps.

To the Editors of Electrical World:

SIRS:—In the ELECTRICAL WORLD of July 11, 1908, the authors gave a table for use in the rapid calculation of illumination in which the watts per square foot required to produce 1 foot-candle of average illumination in large interiors with various lighting equipment were given. The accuracy of the figures for the Nernst lamp given in that table has been since questioned by the officers of the Nernst Lamp Company, and the authors' attention has been called to certain figures which seem to indicate that the present hollow glower Westinghouse Nernst lamp should be given a higher rating as to efficiency than was given in that table. The figures there given of 0.5 watt per square foot to produce 1 foot-candle should apparently be applied to the old type of two-glower Nernst lamp with solid glowers. For the new Westinghouse Nernst lamp an increase in efficiency of 37 per cent over the old form of lamp is claimed by

the makers. We regret that there are not more tests available of these new Nernst lamps. The figures we have from various sources are somewhat conflicting. Nevertheless, since the makers' rating and some tests recently conducted by one of the authors at the Studebaker factory at South Bend, Ind., correspond closely, and since the users of the table wish for something upon which to base calculations pending further information and tests, we would recommend that the figure for the Westinghouse Nernst lamp, in sizes from 88 to 264 watts, equipped with opaline ball globe, be assigned the value of 0.31 for rooms with light walls and ceilings and 0.39 for rooms with light ceilings and dark walls. The figures for the clear tungsten lamp with bowl prismatic reflectors which we gave in the table referred to were 0.20 and 0.25, respectively, for the same conditions.

J. R. Cravath,
Chicago, Ill. V. R. Lansingh.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Production of Heat in Electric Machines.—R. Goldschmidt.—The conclusion of his long paper on the fundamental laws of the generation of heat in electric machines. The author first discusses the case in which the heat produced in a body (for instance in a wire) is first given up to another solid (for instance the insulation of the wire) and then to the air. The author then deals with production of heat by radiation and the screening effect of solid bodies in the path of radiation. He then deals with the temperature drop from the heated interior to the surface of a coil. The higher temperature in the interior of the coil also causes an increase of resistance and this again increases the temperature. Under special conditions this may lead to the burning of a coil in its interior without producing any effect on the outside. If the rate at which the heat is carried off to the outside from the interior is less than the rate of heat production due to increase of resistance the coil may burn out in the interior even if the losses were originally quite low, although this happens only in very rare cases. With laminated sheets the heat is mainly conducted in the direction of the sheets; an approximate formula for this case is given. Finally the author deals with the mutual heat interchange between iron and copper in contact and gives an approximate method for solving such problems.—*Elek. Zeit.*, Sept. 24.

Transformer Oil.—The conclusion of the article on switch and transformer oil. The insulating properties of oil for transformers are first discussed. The windings should be entirely immersed in oil, and provided the oil is kept free from dust and moisture, its insulating properties do not suffer by "ageing," and it can be readily changed and renewed if desired. One of the difficulties with oil insulation is that heated oil dissolves the insulation material, and this is responsible for most of the heavy viscous deposit sometimes found at the bottom of the transformer case after some months' use. This deposit is a very good insulator, but at the same time it is objectionable, as it impedes the circulation of the coil, and thus affects the cooling of the transformer by reason of its choking up the ventilation spaces. If the insulating varnishes and cementing compounds are going to be dissolved out when the transformer is in use, it is obviously much better to avoid their use altogether and thus prevent any possibility of overheating due to the pasty deposit blocking up the ventilation spaces. This simply means thoroughly drying the finished windings in a vacuum oven and then at once putting them in the oil cases under oil, the cases being sealed down so as to exclude dust and moisture. Rubber and rubber compounds must be carefully avoided, as they are all readily attacked by the oil; also ebonite and vulcanite. Vulcanized fibre, on the other hand, is not attacked by oil, but it readily absorbs moisture, and must therefore be very thoroughly dried. Well-seasoned and thoroughly dried wood, when oil impregnated, is an excellent insulating material for coil flanges, etc. The means of excluding moisture and dust are then discussed and a few notes are added on electrostatic attraction between two high-tension conductors, separated by insulating material.—Lond. *Elec. Rev.*, Sept. 18.

Motor-Generator for Search Lanterns.—J. Mueller.—An illustrated description of a special motor-generator made by a German company for supplying energy to search lanterns on board ship. It is so designed as to furnish constant current whatever the distance and the condition of the electrodes.—*La Lumière Elec.*, Sept. 19.

Lamps and Illumination.

Electric Street Lighting.—W. F. Long.—A paper read before the Cape Town local section of the (British) Institution of Electrical Engineers. A series of flame arcs is used for main-street lighting in Cape Town. For side-street lighting tantalum lamps were tried about a year ago and were so successful that all carbon lamps are now replaced by tantalum lamps. As an instance of the saving thereby effected it is stated that the cost of street lighting in Cape Town has been reduced this year by 33⅓ per cent, although some 300 additional side-street lamps and about 20 arc lamps have been erected, whereas the charge per kw-hour consumed for street-lighting purposes has been reduced by only 12 per cent. Electric lighting will now compete with gas lighting in Woodstock and estimates are given to show the economy of lighting with metallic-filament lamps compared with incandescent gas lighting.—Lond. *Elec.*, Sept. 11.

Ultraviolet Rays in Electric Lamps.—A. Blondel.—With reference to the recent controversy concerning an alleged detrimental effect of ultraviolet rays from electric lamps on the human eye, he does not deny the statement made by one side that more ultraviolet rays are contained in ordinary daylight than are emitted from artificial sources of light. He says, however, that no conclusion should be drawn from this concerning the fatique of the eye. The conditions under which the eye operates are very different with artificial light and with daylight. Electric lamps appear faintly violet at night and red-yellow during the day. It may be that the eye is more sensitive with respect to ultraviolet rays at night than during the day. The author had some years ago an internal inflammation of the eye and states that the fatigue was much greater with artificial light than with daylight. After his condition had improved he could work in the evening with an incandescent lamp consuming 3.5 watts per hefner candle. But as soon as he used a lamp consuming 2.5 watts per hefner candle, the light of which was richer in ultraviole⁴ rays, the inflammation returned. It seems that the subject should be considered rather from the physiological than from the physical standpoint.—*Elek. Zeit.*, Sept. 24.

Theater Lighting.—An illustrated description of the electric lighting system of the Drury Lane Theater Royal in London, and especially of the switchboard arrangement.—Lond. *Elec.*, Sept. 18.

Generation, Transmission and Distribution.

Electricity in Agriculture.—K. Krohne.—The first part of a long review of the use of electricity in agriculture in Germany. There are in Germany already quite a number of large farms which have either their own electric generating plant or have combined with other farms in the neighborhood to get electric energy from a common station. Thus the station of Lottin supplies energy to 29 farms of less than 300 morgen, 19 farms up to 1000 morgen, 9 farms up to 2000 morgen and 4 farms up to 3000 morgen (one morgen = 0.63 acres). The author estimates that about 15 per cent of the total mechanical work on German farms could be economically done by stationary electric motors. By using transportable motors this percentage could be increased. The author then begins to deal in detail with

electric ploughing. The article, which is profusely illustrated, is to be continued.—*Elek. Zeit.*, Sept. 24.

Small Steam Turbines.—G. DAVY.—An illustrated article pointing out that while a small steam turbine is much inferior to a large one, yet small steam turbines have distinct advantages in certain cases, for instance, on board ship. Some details are given on small turbo-generators made by a German company. If the rating is 44, 66, 152 kw, the consumption of steam in kilograms per kw-hour is 30, 28.8 and 23.2 respectively.—*L'Ind. Elec.*, Sept. 10.

Suction Gas Plant.—P. W. ROBSON.—A British Association paper on the production of cheap energy by suction gas plants. The author first gives particulars of the actual cost of working a suction gas plant, and makes a comparison with electric supply from public mains, also comparing the electric motor rather unfavorably with the gas engine as regards liability to break down. A detailed description is given of the working of suction producer plants, and of the conditions affecting the efficiency. The author concludes that the claims of suction gas plants for the production of energy are well founded.—Lond. *Elec.*, Sept. 25.

Traction.

Single-phase Traction and Inductive Effects on Telephone Lines.—H. BEHN-ESCHENBURG.—The first part of a long illustrated paper read before the Physical Society of Zurich. Under the conditions existing in Switzerland, induction effects on telephone lines in the neighborhood have been very troublesome in delaying the progress of single-phase traction. The author first gives a historical review of the troubles caused on telephone lines by the single-phase railway from Seebach to Wettingen and describes the extended investigation carried out by the Oerlikon Company, to overcome these troubles. They were found to be due to higher harmonics in the e.m.f. wave of the traction line. The paper is to be continued.—*Elek. Zeit.*, Sept. 24.

Single-phase Railway in Norway.—An illustrated description of the Thamshayn-Lokken single-phase railway in Norway which has a length of 17 miles. Energy is supplied from a hydro-electric plant in form of three-phase currents at 15,000 volts and a frequency of 50. The voltage is reduced in transformers to 600 and the 600-volt 50-cycle three-phase currents are then changed to 6600-volt 25-period single-phase currents by means of motor-generators. The overhead line is built according to the Westinghouse single catenary system. Use is made of three electric locomotives each weighing 20 tons and equipped with four 40-hp motors of the Westinghouse compensated series type. There is also a special motorcar supported on two trucks one of which is fitted with two 40-hp motors.—Lond. *Elec.*, Sept. 25.

Melbourne.—Some further details on the report of C. H. Merz on the electrification of the suburban Victorian Railways around Melbourne. The system recommended for the lines is a protected third-rail at 800 volts, with energy obtained from a large steam turbine-driven generating station, transmitting at 10,000 volts three-phase to rotary converter substations. An acceleration of 0.92 mile per hour per second is recommended, and the trains are to be made up of standard units, each consisting of one motor-coach, with two motors on one truck, and one trailer. The whole net capital cost of the conversion, which is to be taken in hand in four stages, is estimated at $9,000,000, and the operating expenses per train-mile are estimated as 22.06 cents, as against 37.86 cents for steam traction.—Lond. *Elec. Eng'ing*, Sept. 24.

British Municipal Tramways Association.—An account of the proceedings of the first day of the seventh annual conference of the British Municipal Tramways Association. J. Aldsworth, in his presidential address, reviewed the year's work of the Association and touched on a number of tramway problems awaiting solution. He said he was watching with interest the development of the trackless trolley system, which he hoped would prove a valuable factor in the extension and linking-up of tramway systems. A paper was read by H. E. Blain on through-running, in which the advantage of its adoption wherever circumstances permitted was urged, and particulars were given of the methods adopted in a number of actual cases. Two hundred million dollars are invested in the tramway undertakings represented by the Association which comprises practically all the British municipal authorities operating their own tramways. They operated 2500 miles of track with 8000 cars and 40,000 employees, serving a population of 17¾ millions.—Lond. *Elec. Eng'ing*, Sept. 24.

Brakes.—A note with reference to the discussion on brakes at the recent Congress of the International Association of Tramways and Light Railways in Munich. "The reports of the three commissioners differed considerably, and several members suggested that the matter was not ripe for decision; but the friends of the big electric manufacturing firms knew that they could reckon upon a sufficient number of votes and so forced through a resolution which seems to be the most ridiculous pronouncement which could have been made. This resolution states that in the opinion of the experts assembled the ordinary handwheel brake is sufficient for ordinary conditions, but that for heavy cars, long and steep gradients, narrow roads and high speed a mechanical (electric) power brake should be used, and if there are several trailers an electric or pneumatic brake, which are to be considered equivalent." The anonymous writer claims that the treatment of the whole question was careless, as "more important points were not even touched upon by the commissioners." Safety should be the first consideration. It is stated that "an insurance premium of about 8 per cent of the gross revenue was paid by the German tramways to insurance companies, until they started a mutual insurance system. But they still pay about 4 per cent of their gross revenue for accidents. On the other hand, the highest premium paid in Great Britain is 2 per cent, and this under very severe conditions of dense and fast traffic, heavy cars and greasy roads." On this basis, it is thought that in a town like Munich, where the rails are perfectly clean, the insurance premium should be nearer ½ than 1 per cent. "Again, no account was taken of skidding, and every tramways manager knows what heavy expenses this and sanding causes." It is said that skidding can be prevented by efficient track brakes. In the same issue a full report is given of the Bournemouth tramway accident in which seven people were killed and 26 injured. The primary cause of the car getting out of control is stated to have been the incorrect position of the reversing barrel of No. 1 controller at the rear end of the car, which rendered the electrical braking equipment useless. The inspector attributes the displacement of this reversing barrel to the undue slackness of the gear, but in this view he is not supported by the traffic manager. The inspector insists on all cars in service having their full braking equipment in working order.—Lond. *Elec.*, Sept. 25.

Motor Trucks.—P. DAWSON.—A continuation of his long illustrated serial on electric traction on railways. In this article the author deals with the design of trucks suitable for geared motors. For railway work bogie trucks are almost universally used, and various types and makes are described, those with pressed steel side frames being most in favor in England. The method of suspending the motors and their position are also discussed.—Lond. *Elec.*, Sept. 25.

Track Brake.—A fully illustrated description of a new axle-wound track brake, invented by E. Freund. Its action depends on the energy stored in a coiled spring which is automatically kept at a given compression by an eccentric on the car axle.—Lond. *Elec.*, Sept. 11.

Installations, Systems and Appliances.

Limit Switches.—In certain cases of electricity supply, the supply company has made arrangements whereby the consumer pays for energy, either on a contract basis or on a somewhat reduced flat rate, on the condition that the consumer's demand shall never exceed a certain amount. In such cases so-called "limit switches" are used. Two such switches of German make are described. The first is shown in Fig. 1. As soon as the current exceeds the maximum permitted, the consumer's lamps are caused to flicker continuously, and thus warn him that he is taking too much current. *a* is a switch in the main circuit, and *b* is an electromagnet which actuates the balance wheel *c*. The

switch is in series with the magnet-winding and the consumer's lamps. If the current exceeds the predetermined amount, the armature *d* is attracted to the electromagnet, and the balance wheel is set in motion. At a certain angle, the stud *e* on the balance wheel comes in contact with the forked end of the switch, and opens the circuit, extinguishing the light. The magnet no longer attracts the armature, so the balance wheel swings back and the circuit is closed again. So long as the load is not reduced this action is repeated; but, directly the current is reduced below the maximum permitted, the swinging ceases and the switch is permanently closed. The second switch is shown in Fig. 2. When the consumer takes too much current his supply is also cut off for a certain length of time. *S* is the switch in the main circuit, which is opened when the armature shown in the diagram is attracted by the electromagnet *M*. *H* is a

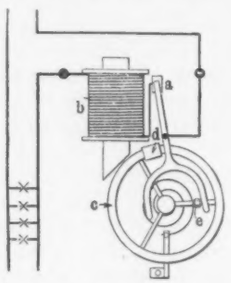


FIG. 1.—DIAGRAM OF OPERATION OF LIMIT SWITCH.

stretched wire in series with the main circuit; c_1 and c_2 are contact springs, which tend to make contact with the corresponding contact studs s_1 and s_2, but are prevented from doing this, as they are fixed to, but insulated from, the stretched wire *H*. There is a third contact stud c_3. The heating effect of the current causes the stretched wire *H* to lengthen, and first to make contact between c_1 and s_1; this, however, has no effect on the switch. Further heating, however, causes contact to take place between c_2 and s_2, which closes the shunt circuit from the positive main through c_2, s_2, s_1, c_1 and *M* to the negative main. The electromagnet is energized and the circuit broken, but a new circuit through c_3, s_1, c_1 and *M* is made. The wire cools and the contact, c_2, s_2, is broken; the electromagnet remains in circuit, however. After further cooling, the contact c_1, s_1 is broken, the

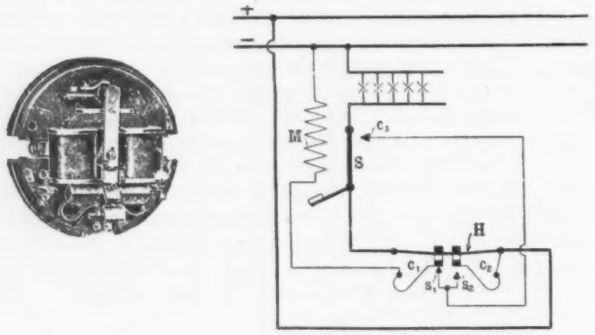


FIG. 2.—LIMIT SWITCH AND DIAGRAM OF CONNECTIONS.

armature is released and the main circuit closed again. This action is repeated continuously if the load is not reduced.—Lond. *Elec. Eng'ing*, Sept. 24.

Spinning Mill.—A fully illustrated description of a new spinning mill in England which has been equipped from the outset with electric driving. Since it is to be used especially for spinning superfine yarn, close speed regulation is essential. There are 10,000 mule spindles. The generating station contains the first Zoelly steam turbines built in England. Three-phase currents are generated at 500 volts; induction motors are used with group driving.—Lond. *Elec. Eng'ing*, Sept. 24.

Wires, Wiring and Conduits.

Aluminum Alloys.—E. Wilson.—A table showing the change of electric conductivity of certain light aluminum alloys due to exposure to London atmosphere. The effect of the atmosphere on other physical properties of these alloys was also studied. Of the various samples mentioned it seems that those containing a comparative high percentage of iron (1 per cent to 3 per cent) have deteriorated comparatively little with respect to electric conductivity and tensile strength. All the results are summed up in a table.—Lond. *Elec.*, Sept. 11.

Porcelain Insulators.—The first part of a fully illustrated description of a British factory which makes both porcelain insulators and the metal fittings and supports with which they are attached to the poles and roofs.—Lond. *Elec.*, Sept. 25.

Electrophysics and Magnetism.

Scintillations of Zinc Sulphide.—E. Rutherford.—An abstract of a British Association paper in which the author first recapitulated his hypothesis that each scintillation which occurs when radium emanation is in proximity to a zinc sulphide screen is due to the impact of a helium atom. This effect is not merely mechanical, but, the author maintained, is due to chemical dissociation, the actual flash being caused either by the dissociation itself or more probably by the recombination which takes place almost immediately. Hence, from this viewpoint it is possible to observe the action of individual atoms. The author's experiments were conducted with a view to ascertaining the efficiency of the transformation of the energy of the atoms into light energy. He enclosed some 200 milligrams of radium bromide in a glass tube, which also contained a zinc sulphide screen, and then compared the luminosity of the latter with that of a standard source of light by means of direct photometry. As a result he found that the illuminating power of the aggregate scintillations was of the order of 0.02 to 0.005 cp, and this showed the efficiency of the transformation of energy of the alpha particles to be approximately 80 per cent. This figure is enormously in excess of what he had anticipated. In reply to questions the author stated that his figures are only approximate, as the ordinary errors which occurred in photometric determinations, must be taken into account, and, of course, they impair the accuracy of his results. The light itself, when examined with a spectroscope gave a continuous blue spectrum, and did not exhibit the characteristic spectrum of zinc.—Lond. *Elec.*, Sept. 11.

Minimum Spark-Potential.—J. E. Almy.—Recent work dealing with spark potentials for very short spark-gaps seems to show that the spark-discharge may take place at potentials far below the so-called "minimum spark-potential." But the present author questions whether these results are wholly conclusive, since there is a possibility that what have been considered spark-potentials for very short sparks may not have been the potentials required to give a disruptive discharge through the gas between the electrodes, but were rather the potentials necessary to give sufficient electrostatic attraction between the electrodes to cause a displacement equal to the spark-gap, thus bringing the electrodes in contact. His investigations appear to show that this is the case. The evidence seems conclusive that with spark-gaps down to at least 0.3 wave-length of sodium light, that is, 0.0000177 cm, a potential of 330 volts is not sufficient to produce discharge through air at atmospheric pressure, while 360 volts is sufficient to do so.—*Phil. Mag.*, September.

Electric Arc Between Solid and Liquid.—G. Athanasiadis.—An account of a number of experiments made to determine the conditions under which an arc may be struck and maintained between an electrolyte and a solid electrode of carbon or metal. Moreover, the influence of a condenser and choking coil, placed in parallel with the arc as in the Duddell arrangement, was studied. Duddell's experiment is successful even when a liquid anode and solid cathode are used. An arc between an electrolyte as anode and a solid cothode may be produced, even wher the latter is immersed some 7 cm or more, by bringing the e.m.f. up to 220 volts. This arc may in certain cases act as a Wehnelt interrupter, but with less vigor. It is impossible to strike an arc between a solid anode and an electrolyte cathode, even at 220 volts; but polarization of the solid electrode may always occur, however far it is immersed in the liquid.—Translated from *Comptes Rendus* in Lond. *Elec.*, Sept. 18.

Negative Electrons from Hot Bodies.—O. W. Richardson and F. C. Brown.—The carriers of negative electricity emitted

by hot metals are electrons. The phenomena are such as would arise if the electrons originate in the metals, from which they were able to escape when their velocity normal to the surface exceeded a certain value. This method of looking at the question was found to give a particularly satisfactory account of the thermal relations of the phenomena, and Richardson then made it probable that the translational kinetic energy of the electrons inside the metal has the same value as that of the molecules of a gas at the same temperature as that of the metal, also that the translational kinetic energy of the electrons outside the metal possesses the same value. In the present paper an account of the investigation of portion of the kinetic energy which depends upon the component of the velocity normal to the emitting surface is given. The conclusion that the average translational kinetic energy and the law of distribution of velocity of the electrons inside a metal are identical with those among the molecules of a gas at the same temperature as that of the metal seems to be of great importance in the electron theory of metallic conduction and thermal radiation.—*Phil. Mag.*, September.

Radioactivity of Potassium.—J. C. McLennan and W. T. Kennedy.—An account of an experimental investigation in which it was found that the activity of uniform layers of active potassium salts is directly proportional to the area of the salt exposed. With uniform layers of a number of potassium salts the activity was found to increase with the thickness of the layer, and maximum activities were obtained with all the salts examined with layers of the salts from 2 mm to 3 mm in thickness. Wide variations were found in the activities of different potassium salts, and of potassium salts of the same composition obtained from different sources, and ordinarily sold as chemically pure. In particular, different samples of potassium cyanide were found to vary widely in their potassium content, but the activities of the different samples were found to be approximately proportional to the amount of potassium present Of all the elements in the alkali group, potassium alone has been found to exhibit marked radioactivity. Both sodium and all of its salts were found to be quite inactive.—*Phil. Mag.*, September.

Radioactivity and Temperature.—W. Engler.—An account of an experimental investigation which seems to show that radioactive phenomena have a temperature coefficient. An increase of temperature accelerates the transformation processes of radium emanation, radium A, B and C. The influence of increase of temperature is restricted to the heating period; after cooling the transformation constants have the same values as before heating. The radium emanation seems not to be a uniform gas.—*Ann. d. Phys.*, 1908, No. 8.

Temperature of the Sun.—D. A. Goldhammer.—A paper in which the author calls attention to an error in former determinations of the temperature of the sun by means of the radiation laws. The only safe foundations for an estimate is, in his opinion, Planck's radiation law, together with Langley's measurements. From these he concludes that the real temperature of the sun cannot be less than 10,000 deg. absolute temperature.—*Ann. d. Phys.*, 1908, No. 5.

Electrochemistry and Batteries.

Dissociation Theory.—Armstrong.—An abstract of a British Association paper in which the author made a strong attack on the "ionic theory." He believes that, contrary to the dissociationists, "hydrochloric acid when dissolved in water is associated with the water molecules. Association between the water molecule and the hydrochloric acid molecule would be feeble and under electrical stress the Cl and H atoms are split off, wandering the one toward the anode and the other toward the cathode." In the discussion the dissociation theory was defended by various speakers, while Oliver Lodge pointed out that modern physical chemistry has no objection to the association of ions with water molecules. Ramsay said that to get at the root of the matter one must consider not merely ions, but electrons.—Lond. *Elec.*, Sept. 25.

Electrolytic Rectifiers.—G. Schulze.—An account of an investigation, carried out in the German Reichsanstalt on the electrolytic valve effect of zinc, cadmium, silver and copper. Zinc and cadmium in an aqueous solution of K_2CO_3 show clearly an electrolytic valve effect of the same nature as shown by aluminum electrodes. Silver in aqueous solutions of H Cl, H Br, H I, and copper in aqueous solution of H F show an electrolytic valve effect which is not caused by a film of gas, but seems to be due to a solid film.—*Ann. d. Phys.*, 1908, No. 7.

Dry Cell.—O. Arendt.—An illustrated description of the "Dewa" dry cell, the feature of which is the provision of good air ventilation so as to remove any gases, and especially hydrogen gas, evolved in the cell. Some results of tests of the Reichsanstalt are reported, and it is claimed that on account of the removal of gases the energy obtainable has been raised by 100 per cent.—*Elek. Anz.*, Sept. 24.

Solid Electrolytes.—F. Haber.—An account of an extended experimental investigation of solid electrolytes, their decomposition by the electric current, and their electromotive behavior in galvanic cells.—*Ann. d. Phys.*, 1908, No. 10.

Units, Measurements and Instruments.

Electrochemical Equivalent of Silver.—F. Kohlrausch.—The author discusses critically the possibility of any error in the determinations of the electrochemical equivalent of silver, made by him and W. Kohlrausch in 1881 and 1883. The conclusion is that there is no correction to be made in their old value, 1.1183 milligrams per coulomb.—*Ann. d. Phys.*, 1908, No. 8.

Electrochemical Equivalent and Temperature.—F. Kohlrausch and R. H. Weber.—An account of an extended investigation made to detect, if possible, any effect of temperature on the value of the electrochemical equivalent. If such an effect exists, it is exceedingly small, although electrolysis of potassium iodide seemed to indicate the existence or possibility of a very small positive temperature coefficient of the electrochemical equivalent.—*Ann. d. Phys.*, 1908, No. 8.

Standards.—The complete report of the British Association committee on practical standards for electrical measurements, relating especially to resistance standards. Also the complete proposed specifications for the definition of the ohm and the ampere and instructions for the preparation of the Weston cadmium cell. The complete report by R. T. Glazebrook on the photometric standard of the (British) National Physical Laboratory is also given. The recommendations made in these reports have already been noticed in the Digest.—Lond. *Elec.*, Sept. 11, 18 and 25.

Symbols.—M. Walker.—A reply to the various criticisms which have been raised against his proposal of creating new symbols. It will not be necessary to remember the new symbols. "Every considerate writer to-day gives a list of the symbols which he uses." He thinks that there will be no difficulty from the printer's point of view. About 30 new symbols would be sufficient for articles on electrical engineering. The name of the symbol should be, when possible, the name of the physical unit represented.—Lond. *Elec.*, Sept. 25.

Measurement of Friction and Windage Losses of Machines.—A. Witz.—If a steam engine or an electric motor is running and the steam supply or electricity supply is suddenly cut off, the speed of the machine will gradually decrease. The author has made extended investigations to find the exact law which determines the decrease of speed with time. If the time t is counted from the moment when the energy supply is cut off and if n is the instantaneous speed at a certain moment, then the relation $n = a\,t^3 - b\,t + c$ is fulfilled, where a, b and c are constants, although they differ from one motor to another. They can be easily determined by measuring the time in which the machine comes to rest, the total number of revolutions which it has made until it comes to rest, and the instantaneous speed at any intermediate time t. If this relation is represented graphically by means of a diagram with t and n as co-ordinates, this curve will be almost a straight line. The degree to which it differs from a straight line, indicates the error which is made in assuming that the friction and windage losses are proportional to the speed. The author shows that from this diagram it is easy to determine graphically the friction and windage losses, and applies the method to a special case in order to show that his method is much more convenient than usual methods.—*La Lumière Elek.*, Sept. 25.

Ampere-Hour Meter.—A. Schwartz and Wagmueller.—A. Schwartz criticises the arrangement of Koenigswerther for preventing the gradual change of the constant of an ampere-hour meter, recently described in the Digest. He thinks that the construction of an oscillating mechanism for displacing the brushes on the commutator results in a very complicated apparatus and that the mechanism will consume considerable power which could be made use of to better advantage in other ways.—*Elek. Zeit.*, Sept. 3.—Wagmueller thinks that these objections cannot

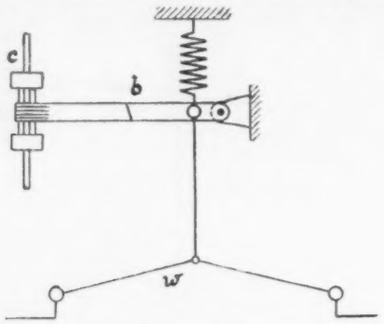


FIG. 3.—DIAGRAM OF METER.

be raised against the arrangement shown in Fig. 3, which is used by a German company. Since a shunt is used with ampere-hour meters, this may consist of a hot wire *w*, connected mechanically with the brush holder *b*, as shown. The hot wire *w* is held under tension by means of a spring. If current passes through the motor the hot wire extends and the brush *b* is displaced on the commutator *c*. This gives the same result as obtained by Koenigswerther.—*Elek. Zeit.*, Sept. 24.

Telegraphy, Telephony and Signals.

Typewriting and Typesetting by Wireless Transmission.—A description of a new system devised by H. Knudsen. On the transmitting instrument a small carrier, to which is fixed a contact spring, passes over a series of stops representing the letters of the alphabet, while a similar carrier moves in synchronism over a series of contacts in the receiving instrument. Any impulses sent from the transmitter at any particular position of the carrier operate, by means of a coherer and relay, a solenoid connected to the corresponding contact of the receiver. This solenoid sucks down a small iron plunger onto the particular lever of the typewriter and so records the individual letter of the alphabet sent. The impulses are not transmitted by the depression of the keys at the transmitting instrument. In fact, the keys for several letters may be successively depressed before the carriage with its contact-maker passes over them. The process of working is as follows: On depressing a key of the transmitter keyboard, a small pin is raised and left in the path of the contact-maker. In passing over the pin and closing the induction-coil circuit, thus giving the necessary waves, the contact-maker pushes the pin down into its normal position and passes on to any other pins which may be raised. The contact carriage is fixed to an endless band passing over rollers and driven by a small motor or clockwork, so that after passing over the whole series of pins it returns underneath to the starting position. An important point which obviously lowers the speed of transmission is that a complete cycle of the contact-maker is necessary if a letter is to be immediately repeated. Similarly, the process is slow if the letters in a word are arranged in the reverse order to the keys. An important point is the accurate synchronizing of the transmitting and receiving apparatus. This is provided for by stopping both the moving bands after each cycle. The transmitter band is restarted automatically by the clockwork movement after a pause, and sends an impulse which immediately starts the band of the receiving instrument. In this way slight differences in speed of the two bands do not result in cumulative errors.—Lond. *Elec.*, Sept. 25; a diagram of the connections is given in Lond. *Elec. Eng'ing*, Sept. 24.

Telephone Currents.—B. S. Cohen.—A paper in full on the production of small variable-frequency alternating currents suitable for telephonic and other measurements. The author describes a modified vibrating-wire interrupter which seems quite useful for this and other purposes. An abstract of this paper has already been noticed in the Digest.—*Phil. Mag.*, September.

Miscellaneous.

Education.—L. C. Miall.—His presidential address to the educational science section of the British Association. In speaking of "book learning," he remarks that the history of learning warns us that it is not good to lay up in our memories a great store of knowledge the use of which lies far in the future. He then discusses the function of science and the difference in scope of various systems of technical education. He does not think that the scientific age will be permanently hurtful to literature. In working out any scheme of instruction, there will always be the necessity of choosing between different subjects. "The accumulation of miscellaneous knowledge of useful things, copius, inexact, inapplicable, may, like rag-picking, leave us ignorant of the world in which we live. Let us try to reach the inner life of something, great or small. The truly useful knowledge is mastery. Mastery does not come by listening while somebody explains; it is the reward of effort. . . Mastery comes by attending long to a particular thing—by inquiring, by looking hard at things, by handling and doing, by contriving and trying, by forming good habits of work, and especially the habit of distinguishing between the things that signify and those that do not." School is merely a preparation.—Lond. *Elec.*, Sept. 18.

NEW APPARATUS AND APPLIANCES

Exhibits at the Atlantic City Railway Convention.

Never were exhibits shown to better advantage than at the annual convention of the American Street & Interurban Railway Association at Atlantic City, N. J., Oct. 12 to 16. The exhibits were housed on Young's Million-Dollar Pier in structures designated as Building No. 1 or Main Building, Machinery Hall, Building No. 2 or Marine Building, and Building No. 3. Uniform signs were used throughout and each exhibit space was provided with complete booth, signs, carpets, etc., erected and ready for the exhibits. The floors were covered throughout with green crex and the color scheme was green and white. Special tracks were laid on the left-hand side of the pier and parallel to it for cars on exhibition. The lighting, especially in the Main Building, was excellent, because the arched ceiling is literally studded with lamps. The following exhibits were among the most interesting of the 175 made:

Device Improvement Company, Hanover, Pa., exhibited in two spaces in the Marine Building its improved armature banding and coil-winding machine, a tension machine for band and magnet wire, a field coil-winding attachment for a banding machine, a commutator slotting machine and an improved armature truck. The various devices manufactured by this company are extensively used in railway repair shops and in central stations. Messrs. Robert E. Manley, Walter Gemmill and LeRoy Stokes were in attendance.

American Blower Company, Detroit, Mich., had an exhibit in Machinery Hall. Among the products that the company displayed were "A B C" dynamo blower, disk fan blower, volume blower, vertical self-oiling engine direct-connected to a Westinghouse generator, sectional hot blast steam heating coil, sample of Vento radiation, and a high-pressure blower holding a ball in suspension in the air column. The latter was also featured in an electric sign on the left tower of the pier. The representatives of the company present were Messrs. Clayton W. Old, Arthur Ritter and E. Morris Lloyd.

STANDARD VARNISH COMPANY, New York, arranged its space in Building No. 2 as a reception room for the entertainment of its patrons and guests. Mr. L. Robinson and Mr. H. B. Chilcote visited the convention in the interests of the company.

GOULD STORAGE BATTERY COMPANY, Depew, N. Y., made an interesting display in Building No. 2, where its different types of cells were on exhibition, together with a number of types of couples. The company was represented by H. N. Powers, C. H. Bradley and H. W. Brow.

BLAKE SIGNAL & MANUFACTURING COMPANY, Boston, Mass., exhibited in Machinery Hall a number of dispatchers' signals, a tube flux for soldering and also wiring specialties. Messrs. E. J. Burke and C. C. Blake explained the merits of the various devices and specialties to interested spectators.

WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., placed on exhibition in Building No. 3 a 5-hp single-phase motor, a 10-hp three-phase motor, a starter for alternating-current motors and a complete line of electrical instruments and transformers. A number of repesentatives of the company explained the merits of the Wagner apparatus.

HOME RUBBER COMPANY, of Trenton, N. J., showed in the Main Building a line of steam and air-brake hose, air pump packings, automobile tires and a full line of N. B. O. packings, the distinctive features of which are claimed to be that they never burn out and never blow out. Representing the company were Messrs. A. R. Foley, H. M. Royal and C. E. Stokes.

EUREKA TEMPERED COPPER WORKS, North East, Pa., exhibited in Building No. 2 specimen commutator segments, trolley wheels, trolley cars, motor bearings, splicing sleeves, controller parts, section switches, brush holders, etc. The company prides itself on the quality of its output and sent Messrs. O. C. Hirtzel, Fred Rundell and H. E. Morris to look after its interests.

NATIONAL VACUUM CLEANER COMPANY, Dayton, Ohio, occupied a space in Building No. 3, where the Green electrically-driven vacuum car cleaner was shown in operation. The rotary vacuum pump is driven by a 2-hp motor and the dust is collected in a galvanized steel tank, the construction of the tank being such that the ingoing dust and dirt are separated from the air before the latter enters the pump. Mr. Carl R. Green represented the company.

HESS-BRIGHT MANUFACTURING COMPANY, Philadelphia, Pa., exhibited in Machinery Hall a set of car wheels and axle mounted on ball bearings, and a set of car wheels and axle mounted on plain bearings, driven by a series motor. Samples of 40-hp armature housings for ball bearings, journal boxes and various styles of ball bearings were on view. Among the representatives that were present were Messrs. Henry Hess, C. J. Hopkins and W. L. Batt.

CHICAGO PNEUMATIC TUBE COMPANY, Chicago, Ill., occupied three spaces in Machinery Hall. Features of its exhibit were electric drills, electric hoists, electric grinders, spike-driving electric drill, vacuum cleaners and a number of air tools. The interests of the company were looked after by an efficient corps, among whom were Messrs. W. O. Duntley, G. A. Barden, W. F. Heacock, W. P. Pressinger, C. B. Coates, Thomas Aldcorn, F. C. Severin, Charles Booth, H. B. Griner and Howard Small.

MCGRAW PUBLISHING COMPANY, publishers of ELECTRICAL WORLD, *Electric Railway Journal, Engineering Record,* and technical books, etc., occupied a large booth to the right of the main entrance to the pier. Copies of the company's various publications were distributed and a display of technical books made. The editorial, business and book departments were well represented. The booth was a center of activity throughout the week, as all the work in connection with the big Convention Daily was performed there.

OHIO BRASS COMPANY, Mansfield, Ohio, showed in Building No. 2 trolley hangers and ears, rail bonds, third-rail insulators, catenary materials, high-tension porcelain insulators, Tomlinson car couplers, universal sander valves and traps, and Collin steam pressure regulating valves. The representatives of the company present included C. K. King, vice-president; A. L. Wilkinson, secretary; G. A. Mead, chief engineer; E. F. Wickwire, general agent, and the following sales agents and managers: A. L. Price, C. H. Tomlinson, N. M. Garland, R. M. Campbell, Nathan Shute, W. H. Bloss F. E. Johnson, E. C. Brown, and J. E. Slimp.

DOSSERT & COMPANY, New York, N. Y., had on exhibition in Building No. 3 combined feed-in and strain supports for trolley wires, solderless cable connectors, cable taps and terminal lugs, rail bonds, Y-connectors, equalizers, reducers, motor leads, insulated joints, signal service clamps, third-rail emergency connectors, junction boxes, receptacles, plugs, elbows and grounding clamps for alternating-current secondary circuits. The representatives of the company in attendance were Messrs. H. B. Logan, C. A. Flynn and D. J. Fitch.

MASSACHUSETTS CHEMICAL COMPANY, Walpole, Mass., occupied two spaces in Building No. 1. Here the company exhibited samples of its well-known insulating materials, including armalac, enamelac, M. C. paint, insulating tapes, splicing compounds and Walpole insulating board. Field coil cushions, motor bushings, switchboard matting, car steps and corrugated matting were also shown. The company was efficiently represented by Messrs. L. O. Duclos, A. E. Duclos, F. J. Gleason and E. W. Furbush.

ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., exhibited in Building No. 3 sample of its chloride accumulator, together with diagrams showing the new split-pole rotary converter developed by the company and used for the regulation of alternating-current loads. Curves showing the regulation produced in this manner were also on exhibition, together with an adjuster, a recently developed device. Those in attendance were Messrs. Charles Blizard, J. L. Woodbridge, G. H. Atkin, Albert Taylor, Edwin L. Reynolds and H. B. Gay.

D. & W. FUSE CO., Providence, R. I., exhibited a complete line of its well-known fuses and cut-outs of all types for 250, 600 and 2500-volt circuits in Aquarium Court. Service switch-boxes for direct-current and alternating-current circuits, fuse boxes, cut-out boxes for railway lighting and motor service, railway-shoe fuse boxes, transformer and high-tension cut-outs, as well as sample reels of Deltabeston magnet wire in both black and white finishes were features of the exhibit. The secretary of the company, Mr. Willard S. Sisson, was in attendance.

LORD ELECTRIC COMPANY, New York, N. Y., exhibited in Building No. 3 the following apparatus: Earll trolley retrievers and trolley catchers, Thomas laminated soldered rail bonds, Shaw lightning arresters, Cosper controlators, Garton choke coils, Garton lightning arresters, Garton "hydro ground," Leco ground plates, points, cap and couplings, together with Leco car seat heat deflectors. Mr. Fred Lord had charge of the exhibit and he was assisted by Messrs. E. Kirkham, W. R. Garton, Ray P. Lee, C. A. Davis, E. A. Robertson and W. P. Cosper.

JOS. DIXON CRUCIBLE COMPANY, Jersey City, N. J., occupied a space near the Marine Building, where it erected a steel exhibition building. This building was built for the purpose of showing the advantages of the Dixon paint for steel work. Within Machinery Hall were shown a complete line of Dixon Ticonderoga flake graphite oils, Dixon lubricants, silica and graphite paint, a lead pencil 10 ft. long, and a rather extensive photographic exhibit of well-known bridges and buildings upon which the company's silica and graphite paint has been applied. Representing the company were Messrs. DeWitt C. Smith, L. H. Snyder, J. A. Condit, John J. Tucker and Thomas Findlay.

ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa., occupied two spaces in Building No. 2, and also two spaces on the exhibit track where there was shown a "pay-within" car. Featured in its exhibit space were rail bonds, Keystone overhead line material, Garton-Daniels lightning arresters, automotoneers, Lyon sheet-steel gear cases, Keystone air sander trap, Keystone pneumatic bell ringer, Keystone lamp guard, pneumatic door opening mechanism, and compressed air door-operating mechanism. A large staff of the company's representatives was present, among whom were Messrs. C. J. Mayer, president; J. W. Porter, first vice-president; J. V. E. Titus, second vice-president; A. H. England, treasurer; M. A. Berg, secretary, and Messrs. E. R. Mason, W. A. Armstrong, Jr., F. H. Jameson, T. F. McKenna, H. G. Lewis, F. A. Strail, Edw. Hammett, R. P. H. Staub, H. R. Swartley, Jr., and F. C. Peck.

The Watson Stillman Company, New York City, N. Y., exhibited samples of its well-known line of hydraulic railway machinery in Machinery Hall. The company was represented by Mr. Edward A. Johnson.

Pichrome Hide Company, Syracuse, N. Y., had on exhibition in Building No. 3 Quride car seat covering and silent gears. Messrs. William H. Roberts, George R. Mitchell and Robert Grossdale represented the company.

Rail Joint Company, New York, N. Y., was represented by Messrs. B. M. Barr and C. A. Cool, of the New York office; Mr. D. J. Evans, of the Chicago office, and Mr. G. W. Smith, of the Baltimore office. The company had on exhibition various types of rail joints in the Aquarium Court.

Standard Underground Cable Company, Pittsburgh, Pa., occupied a space in Building No. 3, where suitably labeled samples of cables, wires, junction boxes and cable terminals were displayed to advantage. Representing the company were Messrs. H. P. Campbell, T. E. Hughes and C. W. Davis.

Speer Carbon Company, St. Marys, Pa.—The products of this company, including carbon brushes for motors and generators and circuit-breaker carbons, were attractively displayed in Building No. 1. Messrs. J. S. Speer and G. P. Fryling attended the convention in the interests of the company.

Sterling Varnish Company, Pittsburgh, Pa., exhibited in Marine Building samples of insulating varnishes and protective coatings, as well as coils of wire, etc., on which the company's products were applied. Mr. A. S. King, Eastern manager of the company, and Mr. W. V. Whitfield were in attendance.

Standard Paint Company, New York City, N. Y., was represented by Messrs. J. G. Satterthwait, Paul J. McCarley and Charles E. Smith. The extensive products of the company are so well known that an exhibit was unnecessary. The company, however, reserved space in the Marine Building, which was attractively decorated and used as a reception room for its many patrons and friends.

Pittsburgh Pole & Forge Company, Pittsburgh, Pa.—The products of this company, embracing standard trolley poles, Verona seamless trolley poles, tubular iron poles, steel insulator pins, rail benders and high-tension transmission pole-top insulator pins, were displayed to advantage in four spaces in Building No. 1. The representatives of the company included Messrs. J. Parker Biggert, T. D. Dallmeyer and B. D. Foster.

Philadelphia Electrical & Manufacturing Company, Philadelphia, Pa., occupied two spaces in Building No. 1. Here the company featured malleable-iron line material of all kinds, brackets, gear cases, oil boxes, splicing sleeve, incandescent street lighting fixtures, absolute cut-outs, fuse boxes, anti-rust paint, etc. Messrs. C. L. Bundy and R. H. Manwaring, whose faces are familiar at almost all exhibits of an electrical nature, were in attendance.

Southern Exchange Company, New York, N. Y., reserved two spaces in the Marine Building. Its exhibit contained samples of overhead pole construction, octagonal yellow pine poles, square yellow pine poles, round Southern white cedar poles, high-grade cross-arms, and photographs of its mills and pole yards. The display was presided over by Mr. E. G. Chamberlin, the genial president of the company, and Mr. A. J. McKinnon and Mr. W. E. Mitchell, the vice-president and sales manager, respectively, were also in attendance.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., manufacturer of telephone apparatus, occupied two spaces in Building No. 3. Here were displayed magneto dispatching telephones, central energy dispatching telephones and kindred equipments, together with telegraph signals, manufactured by the Telegraph Signal Company, of Rochester, N. Y. Mr. H. W. Lucia, of the engineering department, was in attendance, as well as Messrs. J. O. Oliver and E. O. Munson. Mr. H. C. Slemin, the company's advertising manager, was in attendance on Thursday and Friday.

Allis-Chalmers Company, of Milwaukee, Wis., showed in Building No. 3 a very complete operating exhibit of its various types of air brakes and parts, together with steam turbine parts and a pictorial exhibit of its other products. The following representatives of the company were present: Messrs. F. C. Randall, J. F. Dixon, H. W. Rowley, Harry Byrne, A. P. Peck, W. G. Clayton, J. T. Cunningham, St. John Chilton, J. B. Nicholson, S. H. Payne, J. M. C. Lucas, A. H. Whiteside, J. R. Jeffrey, J. H. Denton, W. A. Crawford and I. L. Dimm. Mr. W. S. Heger was in general charge of the exhibit and arrangements.

Western Electric Company, New York and Chicago, occupied a large space in Building No. 1. Those products of the company which were particularly applicable to street railway work, such as overhead material, pole brackets, armature and field coils, commutators, arc lamps, safety strain insulators, high-tension and third-rail insulators, trolley wheels, headlights, fireproof coils and wires, were on exhibition. Among the representatives of the company present were Messrs. A. E. Meixell, H. M. Post, F. Killion, M. A. Oberlander, R. Roth, F. C. Jaeger and R. H. Harper, manager of the railway department.

H. W. Johns-Manville Company was represented by the following-named gentlemen: Messrs. T. F. Manville, J. W. Perry, T. L. Barnes, S. C. Meek, E. E. Schmid, J. McSorley, C. N. Manfred, H. M. Voorhis, G. A. Saylor, H. M. Frantz, R. R. Braggins, W. W. Power, C. W. Schultz, E. B. Hatch and W. H. Kempton. The company's exhibit in Building No. 3 included a number of new devices and materials, together with a great variety of its standard products. The booth was lighted with "Linolite" lamps, which are specially suited for show cases, desk and window lighting. Numerous devices for suspending and anchoring high-tension trolley wires in catenary line construction were shown for the first time. A suspended, disk-type of insulator for high-tension transmission work was also featured. Several forms of indurated fiber, a material which is suitable for third-rail covering and also for insulating battery jars, high-tension oil-switch tanks for transformer stations, etc., were also prominently displayed. Asbestos wood was exhibited to show its adaptability as an insulating and fireproof composition. Car fuse boxes and other "Noark" protective devices for railway motor service and high-tension circuits, including new forms of service, subway and fuse boxes and subway junction boxes of latest approved patterns, were on exhibition. The display also included overhead line material, third-rail insulators, guy anchors, waterproof sockets, friction tape and splicing compound, asbestos pipe, boiler coverings and asbestos roofings and packings.

General Electric Company's exhibit, facing the main lobby, was very comprehensive, and showed all that is modern in railway devices and apparatus. Mounted on a rack and arranged for operation was a complete "Type M" automatic control for four 75-hp motors. The material on display included a trolley base, with pole and wheel; two types of trolley forks and wheels for high-speed and ordinary service; circuit breakers, switches, controllers and handles, fuse boxes, contactors, switchboard panel, suitable for use with "Type M" control equipment; car light regulator and rheostat arranged for operation; complete motor car emergency straight air-brake equipment with compressor, trailer car emergency straight air-brake equipment mounted on rack and arranged for operation; motorman's air valve, complete and in section; emergency valve, governor, various types of gears, armature coils, commutating field coil, exciter field coil, assembled commutator segments, armature windings, pinion, field coil cut to show effects of vacuum compounding; various railway motors, rail bonds, catenary line material, standard suspension line material, electrolytic car lightning arresters, magnetite arc headlight complete with resistance and reversing switch; large self-contained solenoid operated circuit-breaker arranged for operation; direct-current rotary converter panels and alternating-current rotary converter panels. Representing the company were Messrs. W. B. Potter, A. H. Armstrong J. R. Lovejoy, F. H. Gale, F. E. Case, E. D. Priest, J. G. Barry, C. E. Barry, H. N. Ransom, E. H. Anderson, C. H. Hill, A. V. Thompson, C. E. Sprague, C. C. Pierce, J. J. Mahony, H. D. Hawks, W. J. Clark, E. H. Ginn, H. L. Monroe, G. D. Rosenthal, Gen. Irving Hale, R. E. Moore, H. C. Marsh, W. J. Hanley, and Mr. Corbin and Mr. Buell.

General Storage Battery Company, Boonton, N. J.—This company was represented by Messrs. Joseph Bijur, James Dixon and Edward Lyndon. In its exhibition spaces in Building No. 2 were displayed storage battery plates, jars, tanks and accessories in various sizes, together with a "Bijur" regulator on switchboard.

Underfeed Stoker Company of America, Chicago, Ill., manufacturer of the Jones stoker, made no exhibit, but the interests of the company were well taken care of by Mr. Charles S. Crowell, district manager, of Philadelphia, who distributed literature appertaining to the use of Jones stokers, especially in large stations, and who entertained patrons, guests and prospective purchasers in a booth in Building No. 3.

The American Steel & Wire Company, of Chicago, exhibited in Building No. 2 samples of bare and insulated wires and cables, rail bonds and rail-bonding tools, reinforcement for concrete construction, wire rope and wire fences for various purposes. A large staff of representatives was present, including Messrs. H. W. Willson, T. H. Taylor, F. Baackes, C. S. Knight, Jr., C. A. Cragin, F. A. Keyes, C. R. Sturdevant, R. K. Sheppard, J. D. Sutherland, A. C. Greenberg, R. H. Pratt, B. H. Ryder, G. C. Kiefer, E. W. Vaughan, C. Larsen and B. B. Ayers.

Dearborn Drug & Chemical Works, of Chicago, arranged its space in Building No. 1 as a floral park with electric fountains in the center and at the corners and with a miniature railway winding its way around an artificial lake and through the park. The company makes a specialty of analyzing boiler feed waters and furnishes preparations to counteract the harmful ingredients contained in the water. The concern also makes a wide variety of greases, mineral stocks, etc. Mr. H. G. McConnaughy represented the works.

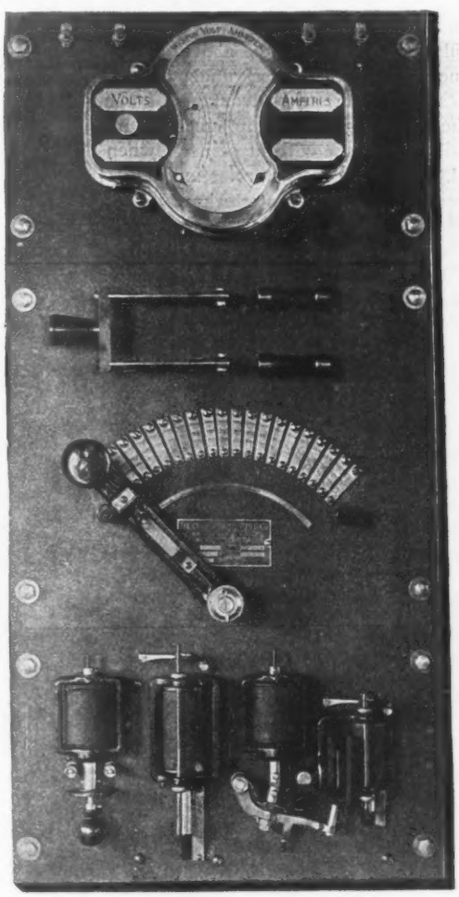
National Carbon Company, of Cleveland, Ohio, manufacturer of the well-known "Columbia" and "Partridge" brands of carbon brushes, occupied a space in Building No. 3. Arranged across the back of the booth were three display boards to which were attached samples of the company's products. These included "Columbia," "Partridge," "National," "Laclede," "Solar" and "Hight Grade No. 15" brushes, as well as carbons for arc lamps, carbon electrodes and specialties of all kinds. Messrs. N. C. Cotabish, F. D. Kathe, O. T. Weaver, A. C. Henry and A. E. Carrier were in attendance.

The A. & J. M. Anderson Manufacturing Company, of Boston, Mass., occupied a space near the entrance to Building No. 3, where it had on exhibition a new remote-control oil switch. This is operated by a solenoid and an air dash-pot permits of the easy opening and closing of the circuit. The oil switch may also be operated manually from the front or the rear of the panel board. Among other exhibits worthy of note were a new brush holder for heavy railway service; anchor and third-rail insulators; pure copper castings; Anderson time switch; a complete line of Aetna railway insulators, as well as of Anderson's line material. A new strain insulator made of drop-forged steel and Aetna composition insulating material was also featured. The representatives of the company present were Messrs. J. M. Anderson, Alfred Anderson, G. C. Crane, W. W. Hincher and Ernst Woltman, the latter being in charge of the exhibit.

The Westinghouse Companies, including the Westinghouse Electric & Manufacturing Company, the Westinghouse Air Brake Company and the R. D. Nuttal Company, occupied a large space in Building No. 1, where there were shown in operation complete air-brake equipments for five-car trains, two motor cars and a single car; a direct-current multiple control outfit and a pantograph trolley. The inoperative portion of the exhibit comprised a display of line material, street-car motor parts, including commutators, field coils, armature coils, armature segments, mica rings and segments, brush holders, bushings, shafts and housings. Street-car circuit-breakers and four types of modern car motors also formed part of the exhibit. In the Nuttal Company's booth gears, pinions, flexible couplings, trolley stands, wheels, harps, etc., were shown. Representing the companies were Messrs. W. M. McFarland, J. C. McQuiston, C. H. Davis, L. M. Reed, A. W. Burke, J. C. Kyle, W. L. Conwell, C. W. Regester, J. A. Brett, S. D. Hutchins, R. E. Adrean, C. P. Cass, P. H. Donovan, R. Burgess and F. M. Nellis.

Battery Charging Rheostat.

The demand for a battery-charging rheostat which will not only meet all requirements of battery-charging service, but which shall possess automatic protective features as well, has led the Cutler-Hammer Manufacturing Company, of Milwaukee, to place on the market the panel here illustrated. This battery-charging rheostat consists of a slate front mounted on an angle-iron frame containing the resistor, the whole being designed for attachment to a wall or switchboard. The panel, which carries all of the operating mechanism, consists of three separate pieces of slate. On the face of the uppermost slate are mounted the terminals, or binding posts, and a volt-ammeter. The middle slate carries a double-pole knife switch and fuses, and below these the contact segments and operating lever, by means of which the charging current is regulated. On the slate at the bottom of



BATTERY CHARGING RHEOSTAT.

the panel are mounted the automatic protective devices, which are: (1) A low-current cut-out, which automatically opens the circuit if the current drops to a predetermined minimum. This prevents the battery from discharging into the line should the line voltage drop below that of the battery. (2) A maximum voltage cut-out. This automatically opens the circuit when the battery voltage reaches the point at which the cut-out is set to operate. (3) A solenoid switch, the opening or closing of which "breaks" or "makes" the main line charging circuit. (4) An overload circuit-breaker which automatically opens the circuit if the charging current rises to the point at which the circuit-breaker is set to operate. This insures the battery against being charged at an excessive rate.

The operation of this type of battery-charging rheostat is as follows: After the battery and line connections have been made

the operator first closes the knife switch and then moves the operating lever forward to the third contact segment, at the same time raising the plunger on the low-current cut-out 1, thus energizing the solenoid switch 3, which closes and permits the charging current to flow to the battery through the resistance. If at the beginning of the charge the operating lever is not in the starting position (that is to say, resting against the rubber stop-post at the left), it must first be brought to the starting position and then moved to the third contact segment as described above. It may then be moved further and further to the right, cutting out one step of resistance after another and increasing the amount of current until the desired amperage is obtained.

Should the current fail, or reverse, the low-current cut-out 1 will release its plunger, thus de-energizing the solenoid switch 3, which will, in turn, open the main circuit. Should the charging current reach the point at which the overload circuit-breaker 4 is set to operate, this will open the main circuit. Finally, when the charge is continued until the battery reaches the voltage at which the maximum voltage cut-out 2 is set to operate, this will automatically open the circuit, thus insuring the battery against an overcharge.

It will be evident from the above description that the use of this panel protects the battery under all charging conditions. It possesses, moreover, the advantage of requiring no attention after the charge is once begun, since the maximum voltage cut-out 2 will cut off the current of itself when the battery is fully charged. As an additional protection the operating lever is provided with an electrical interlock which prevents the operator from closing the circuit to the battery except when the lever is in the "off" position; that is to say, with all resistance in circuit. These battery-charging rheostats are made at the New York works of the company.

New Holophane Reflectors for Tungsten Lamps.

The Holophane Company has just designed an entirely new line of reflectors for tungsten lamps, represented by three types, which will be known by the trade names of "Extensive," "Intensive" and "Focusing." In appearance all are similar to the original bowl-shape Holophane reflectors designed for Gem lamps, but each of the three classes above named gives a distinctive distribution. The Extensive type gives the bowl-type distribution, the Intensive type a good general distribution downward, while the Focusing type is a strong concentrator.

"EXTENSIVE" HOLOPHANE REFLECTOR FOR TUNGSTEN LAMPS.

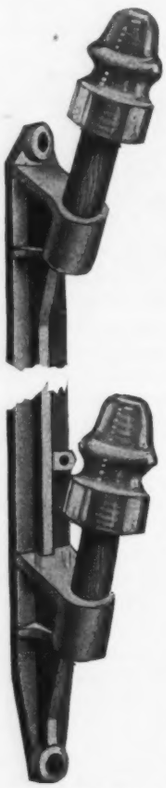
The reflectors were designed to give a certain predetermined result in light distribution and are claimed to have almost ideal photometric curves.

In the designing of the reflectors an entirely new principle was evolved—that of the "merging" prism. As is well known, Holophane reflectors, having a continuous prism from the collar to the edge, lose somewhat in efficiency owing to the fact that the prism is much larger at the bottom than at the neck. To prevent this, a design was made in which prisms of practically equal size are run in steps or banks from neck to bottom. In the new type, instead of an abrupt step between the banks of prisms, the several banks are merged one into the other, adding greatly to the beauty of the reflectors and at the same time giving the maximum efficiency.

The new reflectors are made for 40, 60 and 100-watt tungsten lamps, and there are three types, as above described, for each size of lamp. This makes a very compact line and one which is uniform in appearance. The new line will be handled by the General Electric Company, Westinghouse Company, Franklin Company and the companies comprising the National Electric Lamp Association, as well as by the Holophane Company.

Insulator Wall Bracket.

The Central Electric Company, of Chicago, has placed upon the market the Derby wall bracket shown in the illustration. It will be noted that by the construction adopted the insulator pins are given a slant instead of being placed in a vertical position or parallel with the bracket. This arrangement brings the wires farther from the building, thus materially increasing the insulating distance. The mechanical construction is said to be such, and the parts so proportioned, as to give the greatest strength to resist bending of the base plate, a very important feature in this class of work. By the use of wooden pins the insulation factor is a maximum owing to the fact that moisture is liable to gather, and if an iron pin is used the path from the wire to the ground is much shorter than that afforded with a wood pin. The manufacturer claims that the bracket is being used by some very large transmission companies, and after being thoroughly tried out has been adopted as a standard. It will be readily seen that various modifications in this bracket are possible.



INSULATOR WALL BRACKET.

Electric Curling Iron.

The detachable electric curling iron shown in Figs. 1 and 2 herewith possesses certain meritorious features. The heating element is contained in the curling iron itself so that the heat comes from within and not from without, and is said to be evenly distributed over the surface of the iron from end to end. The flexible cord from the lamp socket is attached to the handle of the curling iron by means of a terminal which can be locked in the handle by simply giving it a slight twist. When the iron is sufficiently heated, the cord may be detached from the handle and the iron is ready for use. A curling attachment slips over the iron for use in making plain curls and marcel waves; in making a pompadour the rod alone is used. It is claimed that by the use of this instrument the cost of dressing hair is less than one-half of one cent, and that it is 50 per cent cheaper to operate than is a gas appliance of like nature. The device is very simple and is made by the Del Sales Company, Chicago, Ill.

FIG. 1.—CURLING IRON.

FIG. 2.—CURLING IRON.

Combined Washing Machine and Wringer.

The Thor electric washer and wringer is one of the numerous household appliances which have lately made their appearance on the market. The apparatus washes and wrings anything from the most delicate fabric to heavy woolens and blankets, and possesses many distinguishing features. A three-roll reversible

FIG. 1.—WASHER AND WRINGER.

wringer is used, by means of which the clothes may be wrung through the lower set of rolls into a tub and after they have been rinsed and blued may be wrung back through the upper set of rolls. The washer has an automatically reversing cylinder which revolves a number of times in one direction, reverses and makes the same number of revolutions in the opposite direction. Each revolution of the washer carries part of the clothes to the

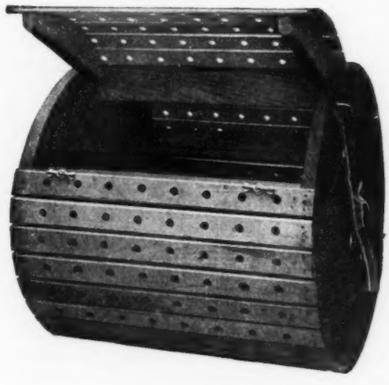


FIG. 2.—CYLINDER OF WASHING MACHINE.

top, spreads them out and then drops them back into the water, exposing, it is claimed, every part to hot suds, which are forced through the perforations of the cylinder. A small heater underneath the machine keeps the water hot. The body of the machine is made of galvanized steel and the cylinder within which the clothes are placed is made of wood. The apparatus contains no beaters or paddles, and is belt-connected to a small motor attached to the supporting legs. The washer and wringer is built by the Hurley Machine Company, of Chicago, Ill.

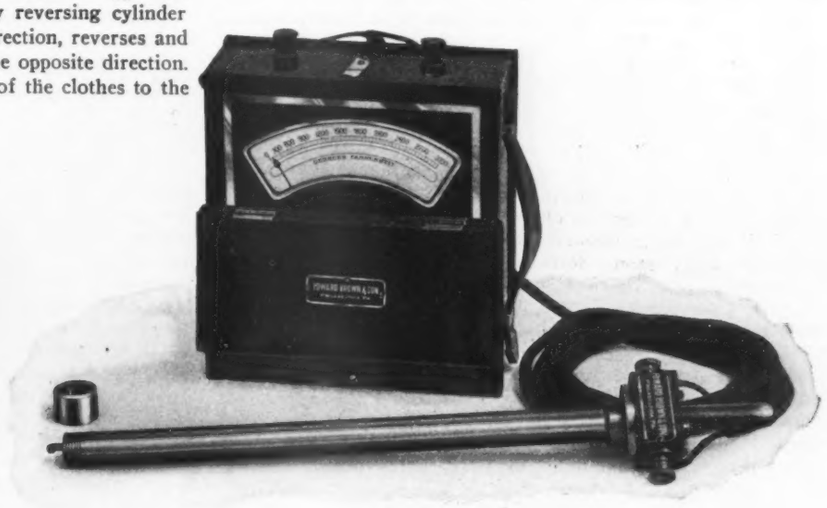
New Electric Pyrometer.

The accompanying illustrations show a new electric pyrometer placed on the market by Edward Brown & Son, 311 Walnut Street, Philadelphia. This pyrometer is designed to stand rough usage, and, at the same time, present the accuracy of the Le Chatelier pyrometer. It is made in two types, the stationary and portable. The former or switchboard type comprises a millivoltmeter to indicate temperature, a thermocouple applied at the point where the temperature is to be measured and leads to connect the thermocouple to the indicator. The millivoltmeter used has a scale graduated to temperature degrees, the scale being exceptionally long with large figures, enabling it to be read at a distance. The portable instrument is shown in the accompanying illustration.

The thermocouple comprises two wires of different metals welded together at one end and suitably insulated from each other and protected. In measurements of temperatures which are not excessive, the thermocouple is constructed of heavy nickel alloy and tungsten alloy wires. These have a fusing point of 2700 deg. Fahr., although it is not safe to use the couple at so high a temperature. For temperatures above 2700 deg. Fahr., a platinum-rhodium thermocouple is used. The wires of the thermocouple are insulated by small fire-clay tubes and mica washers, which serve to hold the wires in the center of the protecting tube. This insulation will withstand heat up to 3000 deg. Fahr. The thermocouple itself is protected by steel tubes for temperatures up to 1600 deg. Fahr. For higher temperatures, tubes of porcelain, quartz, fire brick and graphite are used, each adapted to certain uses.

Where instantaneous temperature measurements are required, as may be the case with molten metals, an unprotected thermocouple is used, this being heavy in construction and especially designed for quick readings.

An advantageous feature of the electric pyrometer is the ability to connect a number of thermocouples to a single indicator by means of a switchboard. By throwing a switch to any one of the several numbered points, the temperature of any one



PORTABLE ELECTRIC PYROMETER.

of a number of furnaces or metal baths, correspondingly numbered, can be shown in a single indicator. The switchboard supplied with the Brown pyrometer uses the knife-switch principle, which is positive in action and prevents poor contacts. It is stated to have an advantage over the simple knife switch in that a single handle only has to be turned to any one of the numbered points, and that it is impossible for more than one thermocouple to be connected with the indicator at one time.

The pyrometer is designed for a number of uses, namely, blast furnace practice, annealing, hardening, tempering furnaces, tinning and galvanizing baths, brass works, etc. For the blast furnace an especially designed thermocouple is inserted in the bustle pipe and another in the top of the dust-catcher for gas temperatures. These can either be connected to the individual indicators or to a single indicator with a switchboard. A recorder can also be connected to the same couples. The pyrometer may also be applied to stoves.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Conditions of trade during the past week showed little improvement over those of the weeks immediately preceding. The unusually warm weather in some portions of the Northwest and West have retarded the sales of winter wares to some extent, while the impending elections have caused all retail merchants to be unusually conservative. House trading in the larger cities in the whole is quiet, except in the Chicago district, where there has been some activity. The heavy movement of crops from the Northwest has done something to improve the railway situation, but this improvement is not yet shown in their reports. The number of idle cars is constantly being reduced, and subsequent earning figures will undoubtedly show more advantageously. The crop situation has not changed. Cotton picking is progressing rapidly, and although there are some reports of holding in certain sections of the South on account of the present depressed condition of the spot market, the staple is being moved rather freely to the seaboard. The winter wheat acreage for next season will probably be less than for 1908. The corn crop has been harvested in most sections, and there is little further danger from frost. The yield will be a little short of last year, but will excel in marketable quality, and there will be a larger return to the producers. In the iron and steel industry there is very little activity at present, and pig iron prices are inclined to be lower. The production for September exceeded that of August by 4.2 per cent, and was the heaviest total recorded since November of last year. Orders for finished product are not coming in with the rapidity that the large manufacturers had hoped for, although in some lines there are many inquiries which may affect future business. One order for 1000 railway cars was reported during the week, and it is said that specifications for a considerable amount of such equipment are being figured upon. Rails and structural materials are easy, and there is little increase in the light demand that has existed during the last three months. Some improvement was reported in the building trade, and reports for September from 79 of the principal cities of the country show a gain in expenditure over September of a year ago of 8.9 per cent. This improvement has helped the lumber trade, especially in the South and far Northwest, where the mills are all reported as being normally busy. The only visible effect of the war scare in Europe has been upon the grain markets. These have been considerably strengthened, and the export demand has been visibly increased. This has been especially true as regards wheat. The general movement of prices on commodities, as reported by *Bradstreet's*, was lower in October than in September, but the present index is 3.7 per cent higher than it was on June 1, when the low levels of this year were reached. War talk in Europe has depreciated the price of cotton, both for spot and for future, from 15 to 25 points. Business failures for the week ended Oct. 8, as reported by *Bradstreet's*, were 256, against 225 the week previous, 192 for the similar week in 1907, 192 in 1906, 183 in 1905 and 196 in 1904.

THE COPPER MARKET.

The war scare in the Balkan states has had the effect in Europe of promoting an active desire to dispose of speculative copper contracts and some pressure to sell the actual metal. Large moneyed interests have been behind the speculative movement and there has apparently been no end to their ability to hold the copper and to standard warrants. The present political complications have caused the first apparent desire to unload. The freer offerings of refined copper and the liquidation of speculative contracts has been responsible for concessions in price in Europe, which would, had the effect been the same in this country, have marked electrolytic copper at about 13 cents. The local market is however under too perfect control to be demoralized by European conditions. In spite of the fact that consumers were buying practically nothing and that the foreigners were sellers no price concessions could be obtained in the local market. The few sales that have been made are of small lots and at full prices. In the meantime production goes on actively and exports are light compared to the record of recent months. Domestic stocks are believed to have increased rapidly within the past 30 days, and now it is figured that the surplus carried in this country is about 159,000,000 lb. or 24,000,000 lb. in excess of that reported by the government at the beginning of the year. The government figures, calculated to Oct. 1, practically bear out this estimate. They are as follows expressed in pounds:

United States production, 9 months		635,000,000
United States imports, 9 months		140,396,000
Total production, 9 months		775,396,000
Stock, December 31, 1907		135,000,000
Total available supply October 1, 1908		910,396,000
Domestic consumption	244,000,000	
Exports	510,029,000	754,029,000
Surplus October 1		156,367,000

Exports from this country since the beginning of the month to Oct. 12 have been 9,744 tons. Prices quoted on the Metal Exchange on that date were:

Lake	13⅜ @ 13⅝
Electrolytic	13⅛ @ 13⅜
Castings	12⅞ @ 13⅛

The London market was as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	59	12	6	59	15	0
Standard copper, futures	60	10	0	60	12	6
Market	Firm.			Firm.		
Sales of spot				400	tons	
Sales of futures				700	tons	

Extreme fluctuations for this year:

	Highest.			Lowest.		
Electrolytic copper, spot	13¾			12¼		
Lake copper, spot	13⅞			12⅜		
Casting copper, spot	13½			12⅛		
London, spot	£64	5	0	£56	5	0
London, futures	64	10	0	56	17	6
London, best selected	67	10	0	60	0	0

ELECTRIFICATION OF THE ERIE.—In regard to the plans for the electrification of the Erie Railroad a statement was published in Wall Street, a few days ago, that Mr. E. H. Harriman had pledged himself to raise $14,000,000. This has been denied, as well as the statement that it was planned to electrify in the near future the entire 220 miles which the $14,000,000 estimate called for. Preliminary surveys have been begun on the section from Jersey City to Suffern, N. J., 32 miles, and if the estimates for this work are satisfactory it will be started in the spring. An official of the road in explaining the Erie's position said: "Whatever money the Erie will require for this purpose it will raise on its own credit. We shall obtain the money by an issue of bonds. The amount of these bonds as yet is indefinite. The amount mentioned—$14,000,000—would be by no means sufficient to electrify the entire road and would be more than enough for the electrification of the Jersey City-Suffern division. We are in no particular hurry about the work. The New Haven Railroad has installed a single-phase system of motive power and the New York Central is trying out the multiple unit system. We shall let them do the experimenting and determine for ourselves which is the more practicable."

TRANSFORMER LITIGATION.—In the United States Circuit Court for the Western District of Pennsylvania, held at Scranton, Pa., Oct. 2, 1908, Judge Robert W. Archbald handed down a decision in favor of the Pittsburg Transformer Company in a suit of the Westinghouse Electric & Manufacturing Company for infringement of the Stanley transformer patent, No. 469,809. A motion having been filed for preliminary injunction against the Pittsburg Transformer Company, Judge Archbald, immediately after the conclusion of the hearing on the above date, handed down his decision from the bench, holding in effect that infringement was not shown, and the complainant's motion for injunction was denied. The above patent, which has been the subject of much litigation during recent years, was granted to William Stanley March 1, 1892, on an application filed Aug. 15, 1888. The patent will expire next year.

NEW HEANY COMPANY ORGANIZED.—A new company called the Heany Company has been organized under the laws of New Jersey to take over the business of the Heany Fireproof Wire Company and also of the Teter-Heany Developing Company, both of which as one concern have plants at York, Pa. The new company, which will largely be controlled by New York interests, will have its main office at 25 Broad Street, New York. The capital stock of the new company will be $3,500,000, of which $750,000 is preferred and $2,750,000 is common. The organization of the new company is as follows: N. Hofheimer, president; J. Alvin Young, vice-president; R. H. Shindel, second vice-president; Richard Irvin, secretary; H. Pendleton Rogers, Jr., treasurer; Curtis H. Hatheway, F. Gordon Brown, W. F. B. Stewart, D. A. Lafean and A. R. Brodbeck, directors. The new company will continue to operate the plants at York, Pa., and these will be considerably enlarged to meet the requirements of the new concern. The lamp business of the Heany Company will be in charge of a separate corporation which will be called the Heany Lamp Company. This is simply a business method of separating the tungsten lamp business from the wire business. Reports that were published some months ago that the Habirshaw Wire Company would probably absorb the Teter-Heany interests proved to be erroneous so far as that concern as an organization is involved. The interests which have now formed the new Heany Company are the same as those which control the Habirshaw company. While not having any direct connection, the two concerns are allied in their ownership.

POWER PLANT FOR AUSTIN, TEX.—The water works, electric light and power plant of the city of Austin, Tex., is installing an Allis-Chalmers steam turbine generating unit. For some time the power facilities of this municipal station have been entirely inadequate and the purchase of additional machinery was imperative. At the present time, a generator direct connected to an Allis-Chalmers 400-hp tandem compound engine is furnishing the current. The load on the unit is frequently so great as to require transferring part of it to an 800-hp compound Corliss engine now being used to drive a number of small dynamos. This engine propels a large steel shaft by means of rope-drive, and, with the aid of several friction clutches, about one-half of the power is transmitted to the dynamos. The procedure of transferring the loads nightly has caused considerable inconvenience, and results in a wasteful expenditure of fuel and wear of machinery. The turbine will increase the output of the plant beyond its rated value, besides materially reducing its operating expenses. It is a 500-kw, 60-cycle, 3-phase, 2300-volt machine designed to run condensing at a speed of 3600 r.p.m. The turbine is of the horizontal, multiple-expansion, parallel, all-around flow type, with patented special construction of blading and other features. In connection with this equipment the city of Austin has also purchased from the Allis-Chalmers Company a 22½-kw exciter, to be driven by a vertical engine, and a large number of lighting transformers.

LONGACRE COMPANY WILL APPEAL TO COURTS.—A rehearing was granted Oct. 12, by the Public Service Commission of the First District of New York to the Longacre Electric Light & Power Company upon its application for permission to issue $10,000,000 of stock and $50,000,000 of bonds. Permission had been refused at a previous hearing and the Longacre company petitioned for a rehearing. The Longacre company's counsel claimed that the refusal of the commission to permit the company to issue securities and finance its business practically amounted to confiscation and invalidated the bonds already issued. It is generally expected that the commission will again refuse permission to issue the securities, in which case the Longacre company will at once take the case before the Supreme Court on a writ of certiorari. This course is provided by the public service act when a rehearing has been had and an adverse decision is unchanged. If the case is carried into the courts a test will be sought of that portion of the law which pertains to the commission's censorship of corporations operating under old charters.

AMERICAN BLOWER ORDERS.—The American Blower Company, of Detroit, Mich., reports the following among its more important orders and contracts received from September 1: Forced draft equipment, Ault & Wiborg, Cincinnati; Hocking Valley Railroad, south shops, Columbus, O.; W. W. Rice Leather Company, Petoskey, Mich.; Empress Hotel, Victoria, B. C.; White Haven, Pa., Sanitarium; Medfield, Mass., Insane Asylum; Gluck Realty Company, Niagara Falls, N. Y.; Central Union Gas Company; Garfield, Utah, Smelting Company; electric light plant, G. Roene, Douglas, Alaska; heating and ventilating apparatus, Western State Normal School, Kalamazoo, Mich.; M. E. Church, Philadelphia; Phillips, Wis., school; Eastern Michigan Asylum, Pontiac, Mich.; Abington, Pa., School; Crystal Springs Bleachery Company, Chickamauga, Pa.; High School, Sisterville, W. Va.; Ford City, Pa., High School; Celluloid Company, Newark, N. J.; Dollar Savings Bank, Youngstown, O.; State Homeopathic Hospital for the Insane, Allentown, Pa.; Mahoning County Court House, Youngstown, O.

LINK-BELT ORDERS.—The Link-Belt Company, of Nicetown, Philadelphia, reports orders recently booked and now being executed as follows: Cuba, sugar conveyors and elevators, three contracts; Delaware, elevating and conveying machinery for soda; Florida, phosphate rock and miscellaneous machinery at four different locations; New York, locomotive coaling stations, belt conveyor, retail coal pockets, conveyor for wood refuse; Ohio, coal pocket machinery; Pennsylvania, conveyors and elevators for fuel testing plant, apron conveyor at coke plant, car haul at coal mine, coal crushing machinery for coal and coke company, coal pocket for retail yard, large "Monobar" conveyor at coal mine; West Virginia, car hauls and coal chutes.

THE WARD LEONARD ELECTRIC COMPANY, of Bronxville, N. Y., reports increasing orders for its portable meter-testing rheostats. They are in use by the New York Edison Company, Commonwealth Edison Company, of Chicago, Detroit Edison Company, Brooklyn Edison Company, etc., and the lighting companies of Tucson, Ariz.; Bay City, Mich.; Tyrone, Pa.; Earlville, N. Y.; Vinita, Okla.; Roanoke, Va.; Utica, N. Y.; Ironwood, Mich.; Chattanooga, Tenn.; Kansas City, Mo.; Pensacola, Fla.; Denver, Col.; New Orleans, La.; Decatur, Ill., etc. There are demands from every section of the country, and many have been sold in Canada. There are over 600 of these load boxes in service.

DOSSERT & COMPANY, NEW YORK, has received an order from the Central Electric Company, of Chicago, for 1000 Dossert solderless lugs ranging in size from No. 6 to 1,250,000 circ. mills, and comprising front-connected, back-connected and 60-deg. angle lugs. The order also includes about 100 Dossert solderless cable taps. Orders have also been received from the San Francisco representative of Dossert & Company for large cable taps and lugs for use on the heavy cables of the Great Western Power Company in California, and from the Illinois Tunnel Company for cable taps, reducers and special terminals for the wiring of the signal service in the Chicago Subway.

CROCKER-WHEELER BUSINESS IMPROVES.—The Crocker-Wheeler Company reports that June of this year was the best month since last October in the point of orders and the size and number of inquiries received, and that July, August and September have each shown an improvement over the month immediately preceding it.

EXPORTS TO GERMANY.—The exports of electrical appliances to Germany during the eight months ended Aug. 31 were $61,076, as compared with $275,745 for the same period in 1907. The exports of electrical machinery were $64,999, as against $64,193 in 1907.

WIRELESS IN THE PACIFIC.—Mr. Julius D. Dreher, U. S. Consul at Tahiti, South Seas, reports as follows on schemes for wireless telegraphy in the Pacific Ocean: "Capitalists who are interested in the extensive phosphate operations on Ocean and Pleasant Islands, of the Gilbert group, and in the new works about to be established on the Island of Makatea, of the Tuamotu Archipelago, have recently started a movement to connect nearly all the groups of islands in the South Pacific by a system of wireless telegraphy. It is expected that the various governments having possessions in the South Pacific will aid in the establishment of the propsed system. Negotiations have already proceeded so far that the success of the efforts seems to be almost assured. As the nearest available ocean cable office to Tahiti is at Auckland, 2,250 miles away, from which a steamship of the Union Line of New Zealand arrives at Papeete once every twenty-eight days, and a direct communication by a steamship of the Oceanic Company with San Francisco, 3,658 miles distant, is had once in every thirty-six days, it will be

understood how deeply interested the French colony of Tahiti and its dependencies are in the complete success of these negotiations. Other groups of islands are equally interested in the establishment of this system which means so much to the inhabitants of these widely separated archipelagoes. The name of the proposed company is the Pacific Islands Radio-Telegraph Company. Of the proposed capital of $350,000, the owners of the phosphates deposits on Ocean and Pleasant Islands have subscribed $50,000. In this radial system there will probably be ten or twelve circles, the largest having a radius of 1,250 miles, and requiring for each station 60 hp.

Financial Intelligence.

THE WEEK IN WALL STREET.

The effect of the war scare in the Balkans upon the market for American securities during the past week has been more or less depressing. Not that Wall Street cares a rap about the quarrels of the minor principalities of Europe or that the desultory hostilities of that section which would probably be designated "war" would have the slightest effect upon the values which are back of our securities, for we would not be practically affected. In fact fighting along the Danube would surely advance the price of American wheat and food stuffs and would probably do something to swell our exports of manufactured articles. The effect on the stock market was retroactive. The Continental bourses and the London market were excited and alarmed. It was generally feared that the trouble might mean the embroilment of the more important powers, that there might be sudden and urgent demands for money and that markets might be seriously demoralized. London especially, the most extensive money centre of Europe, was impressed with the idea that it was a good time to turn marketable securities into money. There was something of a rush to sell and of course this bore most heavily upon American shares. This was true, not because our stocks are less highly regarded from the standpoint of security but because just at the present moment the American market has been pushed to a comparatively much higher level than any other market in the world. The recent depression in business was world wide and the depression in stocks was of the same universal character. The recovery in business has been slow on both hemispheres, and the recovery in stocks on the Continent has followed the gradual return to normal business activity while the prices of stocks on this side have been pushed far out of alignment with commercial conditions. What more natural then that when London desired to realize it should sell the stocks which were high rather than those which were low? Within a week London sold, in this market, almost 300,000 shares of American stocks. These were, too, mostly those issues which have been especially fancied in the recent upward movement. This was true not altogether because these stocks were high, but largely because London, being always well posted on the Wall Street game, had loaded up on these shares at much lower figures. It speaks highly for the strength of our market, however, or rather for the strength and courage of those professionals who are in control of the market, that it absorbed this enormous quantity of stock without, as you might say, "batting an eye." There was no scare, no panic, no demoralization. Prices sagged, of course, under the heavy selling pressure—it would have been uncanny if they had not—but there was no excitement, and on Oct. 12, the last day under review, quotations were practically at the same level they were before Europe began to sell. It is almost inspiring to witness the stonewall firmness of those interests which have determined that high levels shall be reached and shall be maintained. Outside of the Continental situation, conditions are practically unchanged. There is nothing in the domestic happenings to cause either depression or buoyancy. Politics may be having some effect in the way of retarding the return of business, but the apathy in Wall Street is almost startling. It almost looks, at times, as if the financial interests were indifferent as to who would be elected and were not inclined to take alarm over reports of Bryan strength. The monthly crop report of the government did not vary the figures from those already made, and the stiff prices for products of the soil assures the farmers of liberal returns. The railways are busier than they have been for a year and the number of idle cars is being steadily reduced. The heavy selling of stocks by Europe of course created an inordinate demand for foreign exchange and the quotations went up almost to the point where gold exports would be profitable. The money market, however, was little disturbed, the supply being so plentiful that the unusual demand had little effect upon rates. Loans were much more freely made and rates on Oct. 12 were call 1@1½, 90 days 3¼@3½. The quotations in the table are those of the close Oct. 12.

NEW YORK.

	Oct. 5.	Oct. 12.	Shares sold.		Oct. 5.	Oct. 12.	Shares sold.
All.-Ch.	10¾	11⅜	2,100	Int.-Met., pfd.	31¾	32⅝	4,430
All.-Ch., pfd.	32¾	35½	7,400	Mackay Cos.	68¾	68*	450
Amal. Cop.	75	75⅝	95.855	Mackay Cos., pfd.	68⅜	68½*	400
Am. D. T.	35*	35*	——	Manhattan Elev.	137	137*	33
Am. Loc.	46¼	49	11,990	Met. St. Ry.	25*	28	——
Am. Loc., pfd.	104	105	450	N.Y.&N.J. Tel.	116*	116*	20
Am. Tel. & Cbl.	70	71*	100	Steel, com.	45¼	47	380,250
Am. T. & T.	127⅞	127¾	12,100	Steel, pfd.	108½	109⅞	30,564
B. R. T.	49¼	48¾	20,180	W. U. T.	60	58½	1,000
Gen. Elec.	142	143	1,100	West'h, com.	74	75⅛	1,070
Int.-Met., com.	10¾	15⅝	800	West'h, pfd.	88*	88*	——

PHILADELPHIA.

	Oct. 5.	Oct. 12.	Shares sold.		Oct. 5.	Oct. 12.	Shares sold.
Am. Rys.	44¾	44½*	——	Phila. Elec.	10¼	10¼	——
Elec. Co. of A.	10	9⅞	——	Phila. R. T.	20½	23⅜	——
Elec. Stor. B'ty	36	35½	——	Phila. Traction.	88¼	90	——
E. S. B'ty, pfd.	49*	49*	——				

CHICAGO.

	Oct. 5.	Oct. 12.	Shares sold.		Oct. 5.	Oct. 12.	Shares sold
Chi. City Ry.	176½*	176*	——	Met. El., com.	13¼	12¼*	——
Com. Edison	106	108	——	Nat'nal Carbon.	69	69*	——
Chi. Subway	19*	19*	——	Nat. Carb., pfd.	108*	109*	——
Chi. Tel. Co.	123	125	——				

BOSTON.

	Oct. 5.	Oct. 12.	Shares sold.		Oct. 5.	Oct. 12.	Shares sold.
Am. Tel. & Tel.	128	127	——	Mass. E. R., pfd.	52	52*	——
Com'bind Tel.	125*	120	——	Mex. Tel., pfd.	6	6*	——
Gen. Elec.	141	143	——	N. E. Tel'p.	120	122	——
Edison El. Ill.	230	230*	——	W. Tel. & Tel.	8*	8*	——
Mass. Elec. Ry.	10¼*	10¼*	——	W. T. & T., pfd.	80*	80*	——

*Last price quoted.
Shares sold are for week Oct. 5 to Oct. 10.

DIVIDENDS.

Commonwealth Edison Company (Chicago), quarterly, 1½ per cent, payable Nov. 2.

International Steam Pump Company, preferred, quarterly, 1½ per cent, payable Nov. 2.

Electric Bond & Share Company, preferred, quarterly, 1¼ per cent, payable Nov. 2.

Edison Electric Illuminating Company (Boston), quarterly, 2½ per cent, payable Nov. 2.

American Light & Traction Company, preferred, quarterly, 1½ per cent, common, 1¾ per cent, payable Nov. 2.

Central District & Printing Telegraph Company (Pittsburg), quarterly, 2 per cent, payable Oct. 31.

Albany (N. Y.) Home Telephone Company, quarterly, 1 per cent, payable Oct. 20.

Mexican Telephone & Telegraph Company, preferred, semi-annual, 2½ per cent, payable Nov. 2.

National Carbon Company, common, quarterly, 1 per cent, payable Oct. 15.

Lowell (Mass.) Electric Light Company, quarterly, 2 per cent, payable Nov. 2.

Edison Electric Illuminating Company, of Brockton (Mass.), semi-annual, 3½ per cent, payable Nov. 2.

AGENT FOR E. H. GAY & COMPANY.—It has been announced in Wall Street that Mr. John P. Reynolds, Jr., of Boston, has been appointed as a special agent or trustee by Eben H. Gay and Joseph W. Jackson, partners in the firm of E. H. Gay & Company, to manage the affairs of that concern for six months, the creditors agreeing to the appointment. The firm was largely interested in the financing of the Hudson River Electric Power Company, and the troubles of that company caused the present complications in the firm's affairs. In addition to this it held securities of the Haverhill & Amesbury Street Railway Company, Manistee Light & Traction Company, Saratoga Gas & Electric Light & Power Company, Providence & Fall River Street Railway Company, Sedalia Light & Traction Company, and Tacoma Gas & Electric Light Company.

RAILWAYS COMPANY GENERAL EARNINGS.—The annual report of the Railways Company General for the fiscal year ended June 30, 1908, shows total income of $167,071, against $171,019, and net profit of $5,679, against $162,391. The net surplus now amounts to $285,882, against $280,203 a year ago.

BUFFALO & LAKE ERIE STOCK INCREASE.—The Public Service Commission of the Second District has granted the Buffalo & Lake Erie Traction Company permission to increase its capital stock from $5,883,000 to $6,005,000.

PHILADELPHIA RAPID TRANSIT BOND PLAN ACCEPTED.—The Balfour committee of stockholders of the Union Traction Company of Philadelphia, which was appointed to investigate the proposal of the Philadelphia Rapid Transit Company to take over the subsidiary stockholders of the Union Traction in exchange for bonds, has reported favorably upon the proposition. The securities will be used as collateral for a $5,000,000 loan by the Rapid Transit Company. The report of the Balfour committee says: "It is undoubtedly to the best interest of this company to grant the consent asked for, provided full title to the Market Street Elevated Passenger Railway as an operating property can be so pledged with this company as to become its property immediately upon default by the Rapid Transit Company in respect to the payments on account of interest, sinking fund or principal of the proposed loan." It was the opinion of the stockholders that before this transfer was made the directors of the company, who were also directors in the Rapid Transit Company, should resign. This was done. They were: Messrs. P. A. B. Widener, George D. Widener, John B. Parsons, W. H. Shelmerdine, J. J. Sullivan and George H. Earle, Jr. A special meeting of Union Traction Company stockholders will be held on Oct. 29 for the purpose of accepting these resignations and electing successors.

NEW HAVEN ROAD ABSORBS RHODE ISLAND TRACTIONS.—Mr. E. G. Buckland, vice-president of the New York, New Haven & Hartford Railroad Company, has announced the details of the plan by which the railroad is planning to take over the Rhode Island tractions. The deal will involve $22,000,000. The idea of the New Haven is to acquire the stocks and bonds of the United Traction & Electric Company and the bonds of the Rhode Island and Suburban Railway Company. The capital stock of the United Traction is $8,000,000 and it has outstanding $8,894,000, 5 per cent bonds. It owns all of the $5,000,0000 stock of the Rhode Island Suburban which has outstanding $4,682,000 of 4 per cent bonds. The properties belonging to the United Traction Company are under perpetual lease to the Rhode Island Company, which is entirely owned by the Rhode Island Securities Company, the traction arm of the New York, New Haven & Hartford. The present deal, therefore, amounts to little more than a swapping of securities. It simply means that the Rhode Island company will acquire actual ownership of the properties now belonging to the United Traction instead of operating under lease, and is a step toward bringing all of the tractions in Rhode Island under the direct management of one corporation.

MASSACHUSETTS TELEPHONES CONSOLIDATE.—At the forthcoming annual meeting of the Heath Telephone Company in Boston the stockholders will be asked to authorize the lease of the Deerfield Valley Telephone Company and a new arrangement with the New England Telephone Company for long distance connections. The Heath company has agreed to pay 14 per cent on the $30,000 inventory of the Deerfield Valley company for the control of the latter, which is a branch of the New England company. The New England company will allow long distance messages on the Heath lines to be transmitted over their lines. This will mean that in all the western Franklin towns where there are two systems only one will be used, and there will be but a single exchange, instead of two, as in many towns.

NORTHERN OHIO TELEPHONE MERGER.—At a meeting, Oct. 6, in Cleveland, of the stockholders of the United States Telephone Company, the Cuyahoga Telephone Company, of Cleveland, and the Citizens' Telephone Company, of Columbus, it was decided to merge their business. A new company, which has not been named, will act as an operating company, with a capitalization of between $5,000,000 and $10,000,000, and will take over the three independent companies on a lease for 999 years. Other Ohio independent companies will, it is said, be added from time to time. The merger places under the control of the operating company more than 50 per cent of the independent telephones and about 75,000 of the 325,000 telephones in Ohio. The United States company has extensive long distance lines in Ohio and adjoining states.

ELECTRIC ROAD SOLD UNDER FORECLOSURE.—The Oneonta & Mohawk Valley Railroad, an electric line connecting Herkimer and Oneonta, N. Y., was sold at auction Oct. 9 to Joseph A. Starrett, who gave his address as No. 1231 Stebbins Avenue, New York City. The sale was made under mortgage foreclosure brought by the Knickerbocker Trust Company, of New York. Mr. Starrett was the only person present who qualified to bid, and his first offer of $200,000, the minimum figure set by the order of the court, was accepted by the referee. The sale was made subject to receivers' certificates and other obligations amounting to more than $300,000. It is said that the purchase was made for Herbert T. Jennings, who as promoter constructed the road.

COMMONWEALTH EDISON INCREASES DIVIDEND.—At a meeting of the board of directors of the Commonwealth Edison Company, of Chicago, held Oct. 8, it was determined to increase the rate of interest from a 5 to a 6 per cent basis. Consequently there was a quarterly distribution made of 1½ per cent. It is not likely there will be any further increase for a great while. Stockholders, however, may expect from time to time to have the privilege of subscribing for new stock at par, and the rights to subscribe will be valued to the extent of the difference between 100 and the market quotation. The shares, however, are believed now to be firm on a 6 per cent basis and at current quotations offer a profitable investment.

CHICAGO RAILWAYS COMPANY.—The gross earnings of the Chicago Railways Company for July were $962,558, a decline of $5,687 from the earnings of the Union Traction Company, which was the predecessor of the present company in July, 1907. The July expense account also shows a steadily improving condition in affairs of the company under progress of rehabilitation. The month's total operating charges were $614,313, or nearly $42,000 less than in June, when gross earnings were $933,467, compared with July a year ago. Operating cost reveals a decrease of $46,783. Reduction in the operating account resulted in net earnings of $348,245 in July, an increaes of $41,096 compared with the same month a year ago.

LONDON UNDERGROUND BONDS READY.—Mr. W. E. Mandelick, secretary of the Underground Electric Railways Company, of London, has given notice to the holders of the 5 per cent profit-sharing secured notes that the 4½ per cent bonds of 1933 and the 6 per cent income bonds, to which the holders of the profit-sharing notes are entitled, are now ready for delivery. Deposit receipts issued by the Guaranty Trust Company of New York for notes payable in the United States or the notes themselves must be presented for exchange at the Guaranty Trust Company's office.

AMERICAN TELEPHONE STOCKHOLDERS INCREASE.—The number of stockholders of the American Telephone & Telegraph Company now amounts to more than 25,500, an increase of over 2000 since the beginning of the year. This is a gain of 8 per cent in the nine months. Less than two years ago the American Telephone Company had barely 18,000 stockholders, so that there has been an average yearly increase of over 3500 names in the past two years.

REPORTS OF EARNINGS

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Chicago Railways Company:					
July, 1908	$962,558	$614,313	$348,245	.....	.....
July, 1907	968,245	661,096	307,149	.....	.....
International Railway Company (Buffalo):					
Year ended June 30, 1908	$4,702,850	$2,751,335	$1,951,515	$894,397	$838,501
American Telephone & Telegraph Company Operating Companies:					
August, 1908	$9,950,400	$7,292,500	$3,110,800	$614,500	$2,496,300
August, 1907	9,544,900	7,012,700	2,900,800	630,500	2,270,300
Kansas City Railway & Light Company:					
August, 1908	$537,499	$306,609	$230,890	$155,540	$75,350
August, 1907	523,641	263,230	260,411	155,906	104,505

GENERAL NEWS

Construction News.

STEVENSON, ALA.—Fred A. Howe, of Huntsville, Ala., has been granted a franchise to construct an electric light plant in Huntsville. The plant will be operated by a gasoline engine; the rest of the equipment has not been decided upon.

SAFFORD, ARIZ.—The question of establishing an electric light plant in Safford is under consideration.

THATCHER, ARIZ.—The citizens are considering the question of establishing an electric light plant in this village.

HEBER, ARK.—Plans are being made to organize a company for the purpose of installing and operating an electric light plant under the franchise granted to W. H. Horton by the City Council several months ago.

PINE BLUFF, ARK.—A deed has been filed transferring the property and holdings of the former Pine Bluff Light & Water Company to the Pine Bluff Corporation. The property was recently sold at public sale to satisfy a judgment in the Federal court for $450,000. A mortgage has also been filed by the Pine Bluff Corporation to the New York Trust Company for $750,000, the proceeds of which will be used in rebuilding the plant.

ALAMEDA, CAL.—The City Council has granted the Southern Pacific Company a franchise to substitute electricity for steam on its suburban railway system, and also to construct and operate a new railway encircling the east shore of the city.

CHICO, CAL.—The Chico Gas & Electric Company is installing electric meters, with a view of ultimately discarding the present flat rate system. From 1500 to 2000 meters will be required for the entire service. E. W. Florence is manager.

FRESNO. CAL.—The Madera Light & Power Company has been incorporated, with a capital of $50,000, by A. G. Wishon, J. H. Newlin and W. E. Durfey.

LOS ANGELES, CAL.—The Los Angeles Railway Company is planning to erect and equip a substation in the near future.

NAPA, CAL.—Application has been made to the Board of Supervisors by Jasper N. Patrick for a franchise to erect transmission lines for the distribution of electricity for lamps, motors, etc.

ONTARIO, CAL.—The Ontario Power Company is contemplating the construction of a substation to be in operation by Dec. 1. W. T. Leeke is manager.

OROVILLE, CAL.—The Oro Light & Power Company has awarded a contract to R. A. Moncur for the construction of a large storage reservoir in Philbrook Valley.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco has decided to build a combined power station and car house on Pacific Avenue which will be equipped with cable driving machinery from the McAllister Street power house, which will be operated by a 270-kw direct-current motor.

SONORA, CAL.—The Toulumne Power & Light Company has made locations of water rights and reservoir sites on the Toulumne River in the vicinity of Hetch Hetchy. Locations have been made for power houses at three different sites, where electricity will be generated. John Coffe Hayes is president of the company.

IDAHO SPRINGS, COL.—The concentrator plant at the Lamartine Mine has been completed and placed in operation. The mill is equipped with a 20-hp motor, electricity for which is furnished by the United Hydro-Electric Company.

WALLINGFORD, CONN.—The annual report of the municipal electric light plant shows a profit for the past year of $8,810. John P. Stevenson is secretary of the board of commissioners.

WASHINGTON, D. C.—The Washington, Arlington & Falls Church Street Railway Company has awarded A. J. Porter, of Clarendon, the contract for the construction of a substation at Lacey Station.

WASHINGTON, D. C.—The superintendent of the U. S. Capitol Building and Grounds has been authorized by the House Office Building Commission to enter into a contract with the Westinghouse Electric & Manufacturing Company for the completion of the details of the heating, lighting and power plant for the U. S. Capitol and Congressional Building. Elliott Woods is superintendent.

WASHINGTON, D. C.—Bids will be received until Oct. 27 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the navy yards and naval stations the following supplies: Mare Island, Cal., Schedule 417, single-head, motor-driven Landis bolt cutter, a Whiley floor grinder. Bids will also be received until Nov. 3 as follows: New Orleans, La., Schedule 435, for furnishing direct-current equipment for a 50-ton Niles electric traveling crane.

LEESBURG, FLA.—Propositions will be received by the Town of Leesburg until Oct. 23 for an electric light and water franchise in this town. L. M. Johnson is clerk.

BUTLER, GA.—The question of establishing an electric light plant and water works system is under consideration in Butler. For further information address Walter E. Steed.

DOUGLAS, GA.—The citizens on Oct. 3 voted in favor of the proposition to issue $35,000 in bonds, the proceeds to be used for extensions to the municipal electric light plant and water works system. Carl Ayers is engineer.

JULIETTE, GA.—The Council is considering the question of constructing an electric light plant and water works system.

MACON, GA.—A committee has been appointed by the Mayor to investigate the cost of erecting an electric light plant to furnish electricity for street lighting. The members of the committee are: A. E. Chappen, chairman; O. P. Willingham, W. T. Morgan and C. P. Adams.

QUITMAN, GA.—Improvements are being considered for the municipal electric light plant, which include the installation of an alternating-current series arc lamp system and two 200-hp boilers. J. H. Wheeler is superintendent.

SANDPOINT, IDAHO.—The City Council has granted George Hopke, manager of the Humbird Lumber Company, a franchise to operate a water system and furnish electricity in Sandpoint.

ST. ANTHONY, IDAHO.—T. M. Hodgens, principal owner of the St. Anthony Light & Power Company, of St. Anthony, Idaho, has taken over all the power and lighting plants in Fremont County, Idaho, and will consolidate them, building new plants as needed. The plants now controlled by Mr. Hodgens are the Fremont Light & Power Company, the St. Anthony Light & Power Company, the Sugar River Power Company and the Rexburg Power Company.

BELLEVILLE, ILL.—Plans for the organization of a mutual electric lighting company were formulated recently by the business men of Belleville, Ill., for the purpose of obtaining electric lighting service at cheaper rates. It is planned to form a $150,000 stock company. O. L. Armstrong and J. P. Quamm, of St. Louis, Mo., are promoters of the project.

CHICAGO, ILL.—The Chicago Telephone Company has taken over the Zion City telephone system, which includes about 300 telephones.

CHICAGO, ILL.—The Commonwealth Edison Company has leased space in the Railway Exchange, where it will establish a complete exhibit of electrical appliances for household purposes.

CHICAGO, ILL.—Bids will be received by the City of Chicago, Ill., at the office of Department of Public Works, 200 Randolph Street, Chicago, Ill., until Nov. 2 for furnishing generators, boilers, breeching and setting required, engines, switchboard, electric elevators, refrigerating system, pneumatic tubes, pumps, tanks and high pressure piping, furnaces, etc., required in connection with the construction of the new city hall building to be erected according to plans and specifications on file in the office of Holabird & Roche, architects, Monadnock Building, Chicago, Ill. A deposit of $500 will be required to insure the safe return of plans and specifications. Proposals must be made out on blanks furnished at the above office. John L. Handberg is commissioner of public works.

EAST ST. LOUIS, ILL.—The Consumers' Light & Power Company has applied to the City Council for a franchise to furnish electricity in the downtown district, in return for which the company offers to furnish electricity free of charge for lighting the city hall, police station and headquarters of the Fire Department. The service now costs the city about $150 per month. William H. Hauss and others are interested in the company.

JOLIET, ILL.—The Joliet National Bank is making arrangements to erect a power house, plans for which have been prepared by Julien Barnes, 153 La Salle Street, Chicago, Ill. The equipment will include two 85-hp engines, two 50-kw generators and two boilers.

MOMENCE, ILL.—The City Council has granted Harpool & Son, of Morocco, a franchise to establish an electric light plant in this city. A contract was also awarded to them to light the streets of the city.

ALEXANDRIA, IND.—The Indiana Gas & Electric Company is asking for a franchise to operate its lines in this city. The company is preparing to build a large central station on White River, near Anderson, and furnish gas to a number of towns and cities in what is known as the old gas territory.

DANVILLE, IND.—The Indiana Light, Heat & Power Company has secured a site on which it will erect and equip a new power and light plant. The new plant will furnish electricity for lamps, heat and motors in Danville, Brownsburg, Plainfield and other towns in this community and also to the farmers along the lines.

DECKER, IND.—The syndicate headed by Eugene Rush, of Frankfort, has completed all the necessary plans for the construction of a power-dam in White River at this point. Work will commence on the dam as soon as permission is received from Congress.

FORT WAYNE, IND.—The new building which is being constructed by the Wayne Knitting Mills is being equipped to be operated by electricity; several large motors will be installed.

INDIANAPOLIS, IND.—Plans are being made by the Indianapolis Light & Heat Company for the construction of a permanent dam of stone and concrete near the Northwestern Avenue Bridge. C. C. Perry is vice-president and treasurer.

KENDALLVILLE, IND.—The Toledo-Chicago Interurban Company is installing a new General Electric turbine in its power house in this city.

MICHIGAN CITY, IND.—Arrangements are being made to operate the shipping department of the Johnston glass factory by electricity instead of steam power. Two motors will be installed of 25 and 40 hp, respectively.

MICHIGAN CITY, IND.—The Merchants' Mutual Telephone Company has taken over the system of the Central Union Telephone Company (Bell company). The Merchants' company has been reorganized and the capital stock increased from $10,000 to $100,000. The officers of the company are: W. B. Hutchinson, Jr., president; Philip Zorn, vice-president; J. L. Putnam, of South Bend, Ind., secretary, and G. S. Van Deusen, treasurer.

PRINCETON, IND.—It is reported that the Evansville & Southern Indiana Traction Company is considering removing its central power plant from Fort Branch to Patoka, owing to the lack of water, the company frequently having to haul water to supply the boilers.

SPENCER, IND.—The Spencer Light, Power, Heat & Water Company's plant was put in operation on Oct. 3 and is now furnishing electricity for lighting the residences and streets of the town.

TERRE HAUTE, IND.—The Terre Haute-Indianapolis Eastern Traction Company is making arrangements to construct a branch electric railway from Shelburn to Humera, a distance of six miles.

OAKLAND, IA.—Plans are being considered to establish an electric power plant in Oakland, to cost about $60,000. Guy Gilson is reported to be interested in the enterprise.

COUNCIL GROVE, KAN.—The plant of the Council Grove Electric Light & Power Company was badly damaged by fire Oct. 3, putting the plant out of commission and causing a loss of about $5,000. The streets of the city will be in darkness for several weeks.

ELLINWOOD, KAN.—Bids will be received about Oct. 19 for the construction of a municipal electric light plant. The cost of the electric light plant and water works system combined is estimated at about $40,000. W. K. Palmer Engineering Company, of Kansas City, Mo., has charge of the work.

HERINGTON, KAN.—Plans have been prepared for the installation of an electric light plant and water works system, the cost of which is estimated at $30,000, for which bonds have been authorized.

JUNCTION CITY, KAN.—Arrangements are being made by the Junction City Electric Railway, Light & Ice Company to enlarge its plant.

LOUISVILLE, KY.—The so-called Fetter lighting franchise was purchased on Oct. 1 by George G. Fetter for $5,005. The franchise covers the business district of the city.

OAKLAND, ME.—The Emerson-Stevens Manufacturing Company is making arrangements to operate its plant by electricity, owing to the water power having given out.

FRIENDSVILLE, MD.—Plans are being made by the Western Maryland Coal & Coke Company to develop water power of the Youghiogheny River. The company proposes to build an electric plant with an output of 15,000 hp to be utilized for coal mining, lighting and other purposes. The cost of the plant is estimated at $1,000,000. C. L. Pullen, of New York, N. Y., is vice-president.

WESTMINSTER, MD.—The Westminster Gaslight Company, the Carroll County Electric Light & Power Company, the Westminster Water Company and the Citizens' Water & Power Company has consolidated under the name of the Consolidated Utilities Company, of Westminster. The new company is capitalized at $150,000, and the officers are: Dr. James H. Billingslea, president; George M. Parke, vice-president; W. Carroll Shunk, secretary and treasurer.

BOSTON, MASS.—Plans are being made to install additional machinery in the electric generating plant of the Boston Navy Yard, to cost approximately $50,000, bids for which will be received by the Bureau of Yards and Docks, Washington, D. C., in the near future.

BOSTON, MASS.—The Marshall Electric Company has commenced work on the construction of a new factory at Hyde Park, Mass., and is in the market for an overhead trolley system for moving materials about the building and to the freight depot of the New York, New Haven & Hartford Railroad Company, a short distance from the plant.

CHARTLEY, MASS.—The plant of the Norton Electric Light & Power Company has been placed in operation and is furnishing electricity for lighting the residences and will later light the streets of the town. The company also operates a steam-heating system in connection with the electric plant.

GREENFIELD, MASS.—The Greenfield Electric Light Company has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $125,000 additional capital stock, the proceeds to be used to meet the outstanding floating debt.

HOLYOKE, MASS.—The extensive improvements and installation of additional equipment in the municipal electric light plant have been completed and the new apparatus put in operation. The work involved an expenditure of $160,000 and will double the output of the plant. W. H. Snow is manager.

MANCHESTER, MASS.—The citizens have for the second time voted against the proposition to purchase the plant of the Manchester Electric Company to be operated as a municipal plant.

NORTH ADAMS, MASS.—A large electric motor has been installed in the Greylock Mills to furnish additional power to operate the mills.

PLYMOUTH, MASS.—The Plymouth Electric Light Company is planning to enlarge its power house and increase the output of the plant.

SOUTH WALPOLE, MASS.—The Norfolk & Bristol Street Railway Company has been authorized by the State Railroad Commissioners to issue $150,000 in bonds, the proceeds to be used to purchase additional equipment.

WAREHAM, MASS.—The question of lighting the streets of the town by electricity is now under consideration. The New Bedford & Onset Street Railway Company holds a charter permitting it to furnish electricity for lamps, but does not seem disposed to take up the matter. It is said, however, that the company will furnish electricity for operating a local system. A committee has been appointed to investigate the project.

WINCHESTER, MASS.—The citizens are considering the question of having an all-night street lighting service, which can be secured at a cost of about $900 per year above the present price paid, by making a 10-year contract with the Edison Electric Illuminating Company, of Boston, Mass.

DETROIT, MICH.—In the report submitted to the Board of Supervisors the county auditor suggests that an electric light plant be installed in the county building. The present cost of lighting the building is about $5,000 a year, and it is stated that by expending about $6,000 for equipment the building can be lighted for about 25 per cent of the present cost.

AITKIN, MINN.—The Aitkin Telephone Company has been granted a franchise to operate a telephone system in Aitkin.

BIRD ISLAND, MINN.—The Village Council has granted a franchise to A. C. Bowe, of Merriam Park, St. Paul, Minn., to install a telephone system in Bird Island.

BUFFALO, MINN.—An election will soon be held to vote on the proposition to establish an electric light plant in Buffalo.

FARIBAULT, MINN.—Plans are being considered for extensive improvements to the plant of the Polar Star Electric Company which will involve an expenditure of $150,000.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company is planning to install another interurban railway between Minneapolis and St. Paul, via Fort Snelling.

RED WING, MINN.—Plans have been prepared by Arthur L. Abbott, of St. Paul, Minn., engineer, for placing the wires of the Red Wing Gas, Light & Power Company underground, the cost of which is estimated at $31,440.

TERREBONNE, MINN.—Contracts have been awarded by the Northern Minnesota Telephone Company for the construction of a telephone line in Terrebonne, 18 miles long.

JACKSON, MISS.—Longino & McDowell, Capital National Bank Building, Jackson, Miss., are reported to be interested in a project to develop a water power and erect an electric plant.

CHILLICOTHE, MO.—Plans are being made for rebuilding the plant and telephone exchange of the People's Telephone Company in this city.

ELSBERRY, MO.—Bids will be received about Oct. 24 by the city clerk for furnishing and installing a municipal electric light plant in Elsberry, Mo., including the construction of a power house, installing equipment complete and erecting overhead system for street lighting and wiring system. Plans and specifications are on file at the office of the city clerk and at the office of W. A. Fuller, Chemical Building, St. Louis, Mo., engineer.

KANSAS CITY, MO.—The City Council has passed ordinances providing for the installation of ornamental street lamps on Main Street and on Twelfth Street. The city agrees to pay for the electricity used; the merchants along the streets will provide the brackets, which will be attached to the poles of the Metropolitan Street Railway Company, and the Kansas City Electric Light Company will furnish the lamps.

UNION, MO.—The citizens on Oct. 5 voted to grant an electric light franchise to W. W. McCurdy, the plant to be in operation by April 6, 1909, when the franchise of the Tibbe Electric Company, of Washington, Mo., expires.

GREAT FALLS, MONT.—Plans are being considered by Charles T. Main, of Boston, Mass., for the development of two water powers near Great Falls. It is proposed to construct a dam at the falls known as the Coulter's Crooked and Rainbow, situated three miles down the river from Great Falls, where a head of 105 ft. will be obtained. A crib dam about 25 ft. high will be built and a steel penstock 22 ft. in diameter and about 2500 ft. long will extend from the intake to the power house, where wheels and electrical apparatus rated at 30,000 hp will be installed. The second development will be located about 12 miles below Great Falls, and the power house equipment will be a duplicate of the plant at Rainbow Falls. Surveys are now being made and work has commenced on the construction of the coffer dams. A large amount of electricity generated at the plants will be utilized by the Boston and Montana Smelter, at Great Falls.

LIVINGSTON, MONT.—The switchboard and dynamo room of the Livingston Light & Power Company were recently damaged by fire, causing a loss of about $2,500.

THOMPSON, MONT.—It is reported that Senator Donlan, of Missoula, Mont., is engineering a project and has completed the arrangements for financing the construction of a new transmission line from Thompson, Mont., to Murray, Idaho. Electricity will be generated at Thompson Falls, Mont., and transmitted a distance of 31 miles to the mines. It is estimated that in the dry season a minimum of 20,000 hp can be developed. The cost of installation is estimated at about $3,000,000.

MANCHESTER, N. H.—The stockholders of the Manchester Traction, Light & Power Company have voted to increase the capital stock of the company to the amount of $400,000, the proceeds to be used to cancel the floating debt and for the construction of the Manchester & Derry Street Railway, double tracking and other improvements.

ATLANTIC CITY, N. J.—The property of the Atlantic City & Suburban Traction Company, which has been in the hands of a receiver for more than a year, is to be sold at auction on Oct. 31. The railway extends from the Boardwalk in Atlantic City to Absecon and Somers Point.

ALBANY, N. Y.—The Albany & Hudson Railroad Company is planning to enlarge its power house at Stuyvesant Falls. The company has appropriated $75,000 for the work, which will include the installation of one 500-kw turbo-generator set, one frequency changer, an addition to the boiler house and new boilers, condenser, exciter and other equipment. The additions and improvements will increase the output of the plant about 60 per cent. R. H. Smith is general manager.

ALBION, N. Y.—The Village Board of Trustees has entered into a contract with the Albion Power Company for electricity for lighting the streets of the village. The company will furnish 68 arc lamps at $70 per lamp per year, the lamps to burn all night and every night instead of until midnight, as in the past. The company has improved its service, as required by the Public Service Commission, at a cost of $20,000. The application of the A. L. Swett Electric Light Company to install an electric system in Albion has been denied by the Public Service Commission.

AUBURN, N. Y.—Extensive improvements are contemplated by the American Woolen Company to its power plant at Fulton. At the upper falls the dam is to be raised six feet in order to conform with the barge canal plans. Electricity is to be used for power.

BROOKLYN, N. Y.—Contracts have been awarded by the Brooklyn Rapid Transit Company for the construction of a new substation on Thirty-sixth Street, near Fifth Avenue, which with equipment will cost about $200,000.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company is planning to erect a new substation on Thirty-eighth Street near Fifth Avenue at a cost of about $65,000. The station will be equipped with a 2000-kw rotary converter to begin with, and later additional equipment will probably be installed.

BROOKLYN, N. Y.—Plans are being made for extensive improvments at Brighton Beach next season, including the establishment of an ocean power developing plant, which with the newly acquired ocean frontage will involve an expenditure of nearly $2,000,000. It is stated that the plant is to be equipped with four wave turbines to be installed by the Snee Universal Wave Motor Company, of Pittsburg, Pa., and will furnish electricity for lamps, motors and heat.

LONG ISLAND CITY, N. Y.—The New York & Queens County Railway Company is reported to have purchased a tract of land from the Degnon Realty & Terminal Improvement Company on the Flushing Creek meadows, in Newtown, on which it will erect a new car house, shops and power station.

LONG ISLAND CITY, N. Y.—The Board of Estimate and Apportionment has granted a franchise to the New York & Queens County Railroad Company to construct an extension to its system from Whitestone and Bayside, work on which will begin at once. The franchises are for a term of 25 years, in return for which the company is to pay the city $500 for each franchise and 3 per cent. on the gross receipts for the first five years and 5 per cent. thereafter. At the expiration of fifty years, if no agreement is made for a further renewal, the railway becomes the property of the city.

NEW YORK, N. Y.—Plans have been filed for the construction of a power plant on Blackwell's Island near the Queensboro Bridge to supply electricity for the institutions on the island. The plant will cost about $5,000 and will be under the supervision of the Commissioner of Charities.

NEW YORK, N. Y.—Bids will be received by Theodore Bingham, police commissioner, until Oct. 19 for furnishing and installing electric lighting fixtures in the new building to be erected on the block bounded by Grand, Centre and Broome Streets and Centre Market Place, Borough of Manhattan, for headquarters for the Police Department of the City of New York.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities until Oct. 26 for furnishing and installing complete equipment of gas and electric lighting fixtures, consisting of brackets, clusters, ceiling lamps, arc lamps, etc., for the new municipal lodging house, situated near First Avenue and Twenty-fifth Street, Borough of Manhattan. Robert W. Hebberd is commissioner.

OSWEGO, N. Y.—Arrangements have been completed whereby the Mohawk Manufacturing Company will supply the Citizens' Lighting Company with electricity. The contract calls for 300 hp, which will be used for lighting purposes. The power plant at East First Street will be discontinued.

WATERTOWN, N. Y.—The capital stock of the Jefferson County Telephone Company has been increased from $40,000 to $100,000.

CHARLOTTE, N. C.—W. S. Lee and L. C. Harrison, of the Southern Power Company, who are interested in the construction of an extensive interurban electric system, have secured additional franchises to build electric railways through the towns of Lowell and Mt. Holly, cotton manufacturing centers. Several franchises in other towns within a radius of 30 to 40 miles of Charlotte, N. C., have also been secured. The interurban company was chartered under the laws of New Jersey as the Charlotte Power Company, and a franchise, it is understood, will be asked soon to operate the railway into Charlotte.

ROCKINGHAM, N. C.—Work has commenced on the power house of the hydro-electric power development of the Rockingham Power Company at Blewitt's Falls, on the Pee Dee River, in North Carolina. It is estimated that about 30,000 hp can be developed at the falls, of which about 3000 hp will be utilized by the mills in Rockingham.

BOWESMONT, N. D.—Extensive additions are being made to the telephone system owned by S. K. Bartholomew.

CASSELTON, N. D.—B. A. Tenny, owner of the local electric light plant, is planning to make improvements to the electric light system which will involve an expenditure of from $12,000 to $15,000.

CLEVELAND, OHIO.—An option has been secured on a site at the foot of West Eleventh Street for the proposed power plant for the county court-house building. Jared A. Smith, Citizens' Building, Cleveland, Ohio, is president of building committee.

CLEVELAND, OHIO.—At a meeting of the stockholders of the United States Telephone Company, the Cuyahoga Telephone Company, of Cleveland and the Citizens' Telephone Company, of Columbus, held Oct. 6, the three companies were consolidated. The new company has a capitalization of between $5,000,000 and $15,000,000. It is said that other independent telephone companies of Ohio will be added from time to time.

GALION, OHIO.—The Galion Telephone Company has increased its capital stock from $100,000 to $125,000.

LIMA, OHIO.—Mayor Fred C. Becker has vetoed the ordinance passed recently by the City Council repealing another ordinance which provided for a municipal lighting plant to cost $100,000. It is said that it will be very difficult to pass this ordinance over the Mayor's head and that the town is almost assured of a municipal plant.

MIDDLETOWN, OHIO.—Negotiations have been closed by F. M. Tait, general manager of the Dayton Lighting Company, for the purchase of the plant of the Middletown Electric Light & Power Company. Associated with Mr. Hait are Albert Emanuel and L. A. Coppock, of Dayton, Ohio. The price paid for the plant is said to be $100,000. The new company, it is said, will make extensive improvements at a cost of about $50,000.

RICHWOOD, OHIO.—Bids will be received by Ray L. Jordan, Village Clerk, until Oct. 24 for lighting the streets with electricity for a term of 10 years from Nov. 1, 1908, the system to include not less than 35 arc lamps of 2000 cp.

ARDMORE, OKLA.—The Ardmore Brick Company proposes to increase the output of its plant and construct an electric railway to shale deposits.

CHICKASHA, OKLA.—The Pioneer Telephone Company is making arrangements to erect two long-distance telephone lines from Chickasha to Lawton, a distance of 11 miles.

MILWAUKEE, ORE.—The City Council has refused to make an agreement with the Portland Railway, Light & Power Company for lighting the town for a term of five years at the present rates, which are the same as those charged in Portland. The reason given is that the city of Portland had not yet given the company a contract for lighting the streets and would probably get a reduction in cost. Milwaukee in that event would get the same reduction.

OREGON CITY, ORE.—It is reported that Portland capitalists propose to erect a large power plant on Zigzag Creek, near Mount Hood. Filings have now been made on water in the creeks running down the west side of Mount Hood. Joseph R. Keep, of Portland, has filed notice of the appropriation of 6766 cu. in. of water from Camp Creek, Still Creek and Zigzag, and Joseph M. Hanslmair has filed notice of appropriation on 4166 cu. in. from Zigzag. Sixteen cu. ft. of water a second is appropriated by D. H. Fleck from Still Creek, Camp Creek, Wind Creek and Zigzag, the latter acting for the Cascade Electric Company. The water is to be used for the purpose of irrigation, reclamation of arid lands, household or domestic use, water power, mining and electrical power.

PENDLETON, ORE.—A company has recently been organized to furnish electricity in Hermiston, Echo and Umatilla. J. T. Hinkle, of the company, states two plants will be in operation by next summer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 2, for furnishing pneumatic hoists, motor-driven grinder, electric drills, wire rope, wire hose, etc. Blanks and general information relating to this circular (No. 473) may be obtained at the above office or at the

offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

CANONSBURG, PA.—The City Council has adopted a resolution requiring the Canonsburg Electric Light, Heat & Power Company to improve its service immediately or forfeit its franchise.

LANCASTER, PA.—Plans are being prepared by the Lancaster & York Furnace Street Railway Company to extend its system from Millersville through Manor and Lancaster townships, a distance of six miles.

McALISTERVILLE, PA.—The Lost Creek Valley Rural Telephone Company, recently incorporated, will construct a telephone line from Mifflin to Selinsgrove and Middleburg, from Mifflin to Blain, Newport, Millerstown and New Bloomfield, and from Mifflin to Liverpool. A. J. Byers, of Mifflin; A. W. Herr, of McAlisterville, and J. O S.mith, of Bunkertown, are among the incorporators.

READING, PA.—The Reading Power Company is planning to erect a power plant, which, with equipment, will cost about $1,500,000.

READING, PA.—The Interstate Railways Company, which controls about 450 miles of electric railways in eastern Pennsylvania, is planning extensive improvements and extensions to its system, including the construction of a new power plant, with an output of 20,000 kw in Reading and the building of a new electric railway from Reading to Hamburg.

WASHINGTON, PA.—The National Telephone Company has applied to the City Council for a franchise to operate a telephone system in East Washington Borough.

PAWTUCKET, R. I.—The new plant of the Lumb Knitting Company is nearly completed and will be placed in operation about Nov. 1. The entire plant will be operated by electricity.

CALHOUN FALLS, S. C.—A 1000-hp steam power plant is being installed in the Calhoun Mills and the machinery will be equipped to be operated either by steam or electricity. All the machinery has been purchased and will be placed in operation soon. James P. Gossett is president of the company.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D C., until Nov. 14, for installing a coal and ash plant at the central power plant at the navy yard, at Charleston, S. C. William M. Smith is acting chief of bureau.

SPARTANSBURG, S. C.—The Electric Manufacturing & Power Company, which controls a power plant at Gaston Shoals, on Broad River, is reported to be making plans for the construction of another plant to be located either on Broad River, or at Nesbitt Shoals, on Tyger River.

WOODRUFF, S. C.—The mill buildings of the W. S. Gray Yarn Mills have been completed, which will be equipped with 10,000 spindles and complementary apparatus. The plant will be operated by electricity. W. H. Gray, of Woodruff, is president of the company.

LEWISBURG, TENN.—The Board of Mayor and Aldermen has decided to accept the proposition of the Lewisburg Light & Power Company to take over the municipal electric light plant, the sale to go into effect immediately. The new company assumes the outstanding bonded indebtedness of the municipal plant. Plans are being made to improve the plant and service at once, and also to establish an ice factory and cold storage system in connection with the plant.

SPARTA, TENN.—Water power properties located about one mile from Sparta have been purchased by O. H. Anderson, J. R. Tubb and others, who propose to construct a dam and develop power to generate electricity, which will be transmitted to Sparta. The cost of the work is estimated at $25.000.

GAINESVILLE, TEX.—The Gainesville, Whitesboro & Sherman Railway Company has awarded a contract for the construction of its proposed electric railway, 39 miles in length, to J. P. Hornaday & Company, of New York, N. Y.

GALVESTON, TEX.—A. S. Drewry, superintendent of the Electric Light Department, recommends an expenditure of $30,000 to improve and increase the electric lighting service of the municipal electric light plant.

HUBBARD CITY, TEX.—The Union Central Light & Ice Company is making arrangements to extend its transmission lines to four surrounding towns to furnish electricity for lamps and motors, for which the necessary franchises have been secured. The company will issue $75,000 in bonds, the proceeds to be used for extensions.

TEMPLE, TEX.—The City Council is considering the question of calling an election to vote on the proposition to issue bonds for the construction of an electric light plant.

PORTSMOUTH, VA.—The Parker Hosiery Mill & Dye Works has awarded contracts for the construction of a new plant, the cost of which is estimated from $20,000 to $50,000. The machinery in the new buildings will be operated by electricity.

PURCELLVILLE, VA.—The Purcellville canning factory building has been purchased by W. Warrington Evans, of Washington, D. C., in which he proposes to install an electric plant and furnish Purcellville, Round Hill, Hamilton and Bluemont with electricity.

SCOTTSBURG, VA.—Plans are being considered by the Talley's Falls Improvement Company for developing the water power of Talley's Falls, on Dan River, five miles from Scottsburg, where it is estimated that from 10,000 to 12,000 hp can be developed. It is proposed to furnish electricity in Virginia and North Carolina, including the copper mining properties for manufacturing purposes and for electric plants. The cost of the dam and transmission lines is estimated at about $1,000,000. M. R. Lewis is engineer.

BAKER, WASH.—C. R. Franklin, of Anacortes, Wash., is installing an electric light system for Burpee's Mill at Grassmere siding. The motive power is steam, which operates a 7½-kw General Electric generator.

CASHMERE, WASH.—Ball & McNerney, of Seattle, Wash., have secured the contract for installing the electric light system and water works, for $6,112. The contract for the lighting system was awarded to Nixson & Kimmell, of Spokane, Wash., for $2,271. The contract for furnishing electricity for operating the plant was awarded to the Valley Power Company.

MILES, WASH.—The Spokane River Telephone Company will extend its telephone line up the Spokane River to the Powers Ranch, a distance of four miles.

WATERVILLE, WASH.—Messrs. Gray and Barash, of Seattle, Wash., promoters of the Entiat Power Company. will begin work at once on the construction of their new power house at Waterville, Wash. Electricity to be generated by the plant will be used for pumping stations at Wenatchee and Waterville and at other places along the Columbia River.

SEATTLE, WASH.—The Great Northern Railroad Company, which is constructing an electric power plant two miles west of Leavenworth, Wash., to supply electricity for operating its trains through the tunnel in the Cascade Mountains, near Stevens Peak, is nearly completed and will develop 12,000 hp. Plans have been made for the construction of a second power plant, with the same rating, between the present plant and Leavenworth.

SPOKANE, WASH.—The Acme Portland Cement Company, of Spokane, Wash., is planning to erect a large cement plant at a cost of $675,000. The plant will be operated by electricity and 2000 hp will be required to operate the machinery.

AMBERG, WIS.—W. L. Buckman and L. Redman, who recently purchased the Dave's Falls, are having surveys and estimates made for the construction of a dam and power plant. It is estimated that 1000 hp can be developed. It is proposed to construct a dam and install a rock crusher besides furnishing electricity for other purposes.

BURLINGTON, WIS.—The Burlington Electric Light & Power Company has been awarded the contract for lighting the streets of the city for a term of five years. Under the terms of the contract the company is to furnish 10 1200-cp arc lamps at $65 each per year, and 90 incandescent lamps of 80 cp at $27 per lamp per year.

MANITOWOC, WIS.—The capital stock of the Rockland Telephone Company has been increased from $1,500 to $3,000. Albert Moede is president.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has decided to construct a new telephone line direct from Milwaukee to Green Bay at once. Alonzo Burt is general manager.

MILWAUKEE, WIS.—It is said that Mayor Rose will sign the resolution for the building of the municipal electric light plant. Action has been delayed pending a report of the Board of Public Works of the cost of a plant in accordance with the specifications and plans of R. W. Hunt & Company.

MONROE, WIS.—The contract for the construction of the new farmers' line, to be known as the Monroe and Washington telephone line, has been awarded to E. C. Divan, of Browntown. The line will be about 12 miles in length. A. C. Dodge, F. E. Benkert and others are interested in the project.

TWO RIVERS, WIS.—Louis Hartung is reported to be interested in a proposition to install an electric light plant in Two Rivers.

WEST ALLIS, WIS.—The City Council has granted the West Allis Light & Power Company an indeterminate franchise, which permits the company to generate and sell electricity for lamps and motors; also illuminating and fuel gas. Under the term of the franchise the company must have its plant in operation within a year, and the city can at any time acquire the plant after an appraisal is secured from the State Railway Commission.

LANDER, WYO.—R. C. Adams, of Washington, D. C.; W. E. Rowsey, of Muskogee, Okla., and Leo Adams, of Washington, have purchased 220 acres of oil land in the Dallas field and propose to construct a power plant to generate electricity. It is proposed to sink a number of wells and use crude oil for generation of steam. Electricity is to be distributed throughout the entire region centering at Dallas, including the South Pass district to the south and the Copper Mountain district to the north.

EDMONTON, ALB., CAN.—The City Council has decided to sell the municipal telephone line to St. Albert to the Alberta Government.

PINCHER CREEK, ALB., CAN.—The town has signed a contract with a local company for the supply of electric light and power service. The company will be known as the Pincher Creek Electric Light Company.

RED DEER, ALTA., CAN.—The Red Deer Electric Railway Company is planning to commence work on the construction of its proposed electric railway from Red Deer to Nevis early next spring. The railway will be about 40 miles in length. Electricity for operating the road will be secured from the plant of the Western General Electric Company, of Red Deer. It is the intention of the company later to build two power stations, one at Red Deer and the other at Coalbanks. George W. Smith and William A. Moore are among the directors.

NELSON, B. C., CAN.—The City Council has authorized Smith, Kerry & Chace, of Toronto, Ont., consulting engineers, to prepare plans for

the construction of an extension to its hydro-electric plant on Kootenay River, including machinery for a second unit having a rating of 1000 kw; also for a transmission line and equipment for a substation.

WINNIPEG, MAN., CAN.—William G. Chace, of the firm of Smith, Kerry & Chace, Toronto, Ont., consulting engineers, will have charge of the construction of the municipal electric light plant.

WINNIPEG, MAN., CAN.—The City Council has voted to appropriate $22,000 additional for expenditures necessary on the power scheme before winter sets in, of which $6,500 will be used for the construction of 24 miles of telephone lines.

TWILLINGATE, N. F.—Plans are being made to establish an electric light and power plant in Twillingate by Boston capitalists, which will be installed under the supervision of Frederick S. Palmer, 103 Bedford Street, Boston, Mass., who is president of the company. The equipment of the plant will include two 250-kw steam turbines, and it will furnish at the start electricity for about 6000 lamps, including 500 street lamps.

LETHBRIDGE, ONT., CAN.—The City Council has secured the services of Smith, Kerry & Chace, of Toronto, Ont., consulting engineers, to prepare plans and to construct a steam electric generating station, which will include part of the apparatus in the plant recently purchased by the city from the Lethbridge Electric Company. The new station will have an output of approximately 1000 kw, including steam-water pumping unit, coal-handling machinery, etc.

ORILLA, ONT., CAN.—The citizens have voted in favor of the by-law to appropriate $30,000 for extensions to the municipal electric plant at Ragged Rapids.

ST. CATHARINES, ONT., CAN.—The City Council has decided to accept the offer of the Cataract Power Company to light the streets of the city for a term of five years at the rate of $50 per arc lamp per year. Under the old contract the city paid at the rate of $72.50 per lamp per year.

WEST TORONTO, ONT., CAN.—A by-law has been passed accepting the proposition of the Inter-Urban Company for street lighting service in place of the Stark Electric Company, now assigned, who had the contract for lighting this town.

PUEBLA, MEX.—Alexandra M. Azan is reported to be interested in the organization of a company to be capitalized at $400,000 to install a second telephone system in Puebla. In addition to the local system, the company will erect long-distance lines to Atlixco, Cholulu and Tlaxcala and establish local exchanges in the above cities. Mr. Azan states that the Federal Government will construct a long-distance telephone line from Puebla to the City of Mexico.

New Industrial Companies.

C. A. CHAPMAN, Inc., has been chartered, with a capital stock of $5,000, by Gale Plocki, Arthur J. Donovan and Fred J. Mueller.

THE OHIO ELECTRIC CAR COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $1,000 by Norton T. Horr and others.

THE TOLEDO ELECTRIC VEHICLE COMPANY, of Toledo, Ohio, has been incorporated, with a capital stock of $50,000, by W. E. Allen and others.

THE TRIO MANUFACTURING COMPANY, of Rock Island, Ill., has been chartered, with a capital stock of $40,000, to manufacture electrical machinery by W. H. Dickman, C. A. Walker and J. T. Marron.

THE J. E. SIEBEL SONS' COMPANY, of Chicago, Ill., consulting engineers, has been chartered, with a capital stock of $5,000, by John E. Siebel, Frederick P. Siebel and Ewald E. Siebel.

THE ELECTRICAL CONSTRUCTION & INSULATING COMPANY, of Cincinnati, Ohio, has been incorporated, with a capital stock of $25,000, by Ivan Bushong, A. W. Potts, H. G. Harstman and others.

THE INTERNATIONAL FOTOFONE COMPANY, of Dover, Del., has been incorporated, with a capital stock of $300,000, by Frank D. Levermore, Charles H. Perry and L. Rodney Berg, of New York, N. Y.

FERGUSON BROTHERS ENGINEERING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $5,000. The directors are: William Ferguson, John B. Ferguson and Robert Ferguson.

THE REX ELECTRIC COMPANY, of Kingston, N. Y., has been incorporated, with a capital stock of $600,000, to manufacture electrical lamps, burners and fixtures by E. M. Betts, Charles J. Kleber and B. B. Maloney, all of New York, N. Y.

THE CRESCENT STEEL & WIRE COMPANY, of Camden, N. J., has filed articles of incorporation with a capital stock of $125,000 by Charles Hyde, I. E. Higgins and Louis Caplan. The company proposes to manufacture iron, steel, coke, etc.

THE REXELECTRIC PIANO PLAYER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $350,000 and the following directors: George H. Brooke, of New York, N. Y.; George W. Badger and C. E. Martling, of Brooklyn, N. Y.

THE SAFETY POWER TRANSMISSION COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $50,000 by Frederick J. Schussel, of Oyster Bay, N. Y.; Henry F. M. Podeyn, of Brooklyn, N. Y.; Nelson L. Jacobus, of East Orange, N. J.

THE GRENESTO ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $5,000 to manufacture machinery. The directors are George F. Parmelee and Stuart M. Beard, of Bronxville, N. Y., and Oscar P. Ostergren, of Brooklyn, N. Y.

THE MILLER OWEN ELECTRIC COMPANY, of Camden, N. J., has been incorporated by V. Murray, Achworth Martin and Doering Bellinger. The company is capitalized at $25,000 and proposes to manufacture electric motors, dynamos, etc., and also carry on an electrical and mechanical engineering business.

THE ELBRIDGE ENGINE COMPANY, of Rochester, N. Y., has been incorporated, with a capital stock of $25,000, to manufacture machinery, engines, motors and vehicles. The incorporators are: Lyman J. Seely, of Rochester, N. Y.; G. E. De Long, of Syracuse, N. Y., and W. H. Salmon, of Buffalo, N. Y.

THE DOMINION CONSTRUCTION COMPANY, of Jersey City, N. J., has been chartered, with a capital stock of $500,000, by P. G. Ward, E. H. Swearer and Charles W. Fralich. The company proposes to operate public and private works, including steam and electric railways, telephone and telegraph lines, etc.

THE SOUTHERN ELECTRIC & MANUFACTURING CORPORATION, of Richmond, Va., has been incorporated, with a capital stock of $25,000. The officers are: B. B. Brauer, president; E. D. Moore, vice-president; J. W. Church, secretary and treasurer. The company proposes to manufacture and sell the Brauer automatic time switch.

THE NEWARK FAN & LOCK COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $125,000, to manufacture, lease and sell fans operated by electricity, gas, steam or compressed air, and also to manufacture and sell keyless locks and other novelties. The incorporators are: Dario Roberti, Victor Tortariello, Vincent Mazziotta, Raffaello Angiolillo, Anthony Panico and Paolo Natalizio.

New Incorporations.

NUNEZ, GA.—The Mutual Telegraph & Telephone Company has been incorporated, with a capital stock of $3,000.

CHAMPAIGN, ILL.—The Cairo & St. Louis Railway Company has been incorporated with a capital stock of $100,000. The incorporators are William B. McKinley, L. E. Fischer and George M. Mattis.

HAYFIELD, IA.—The Madison Township Mutual Telephone Company has been incorporated with a capital stock of $1,500.

MARSHALLTOWN, IA.—The Farmers' and Merchants' Telephone Company has been chartered with a capital stock of $250,000. The company proposes to take over the mutual telephone companies of Central Iowa operating telephone lines in Calhoun, Dallas, Hamilton, Story, Greene and other counties.

PORTLAND, ME.—Articles of incorporation have been filed for the Cairo Railway & Light Company with a capital stock of $1,000,000. The officers of the company are: G. F. Duncan, president; Edward Woodman, treasurer and clerk, both of Portland, Me.

MONMOUTH JUNCTION, N. J.—Articles of incorporation have been filed for the Middlesex Telephone Company, with a capital stock of $10,000, by Clarence S. Grover, D. C. Mershon and Andrew Ely.

MECHANICSVILLE, N. Y.—The Dwaas Electric Company has been incorporated, with a capital stock of $20,000, to furnish electricity for light, heat and power. The incorporators are: Edward E. Sabourin, of Sandy Hill, N. Y.; George Clifford, of Schenectady, N. Y., and Harold J. Werner, of Mechanicsville, N. Y.

PORT JERVIS, N. Y.—Articles of incorporation have been filed for the Interstate Hydro-Electric Company, with a capital stock of $10,000, by Charles F. Wright, of Susquehanna, Pa.; Edward P. Emerson and Isaac N. Beardslee, of Port Jervis, N. Y.

DAYTON, OHIO.—The Dayton, Springfield & Xenia Southern Railway Company has been incorporated, with a capital stock of $10,000, by W. S. McComanghey and others to construct an electric railway from Xenia to Wilmington and later to Cincinnati.

LOGAN, OHIO.—The Logan Light & Power Company has been chartered, with a capital stock of $25,000, by John R. Rempel and others.

DADE CITY, FLA.—The Dade City Light & Power Company has been incorporated to furnish light and power in Dade City.

EL DORADO, OKLA.—The El Dorado Telephone Company has been chartered, with a capital stock of $50,000, by W. P. Ritchie, P. V. Blain, Bama Arrant and others.

BIRCHRUNVILLE, PA.—The Birchrunville Rural Telephone Company has been formed to erect a rural telephone line in Birchrunville to connect with the Phoenixville exchange. J. B. Mosteller is president of the company and A. C. Walker treasurer.

HARRISBURG, PA.—The Cumberland Railway Company has been chartered with a capital stock of $12,000 to construct an electric railway in Cumberland County three miles long, terminating at a point near Balfour. The incorporators are: W. E. Glatfelder, of Balfour, president; G. A. Albright, D. W. Sunday, of Carlisle, and J. F. Nace, of Balfour, and others.

CAMERON, S. C.—Articles of incorporation have been filed for the Cameron Telephone Company. The officers are: James M. Moss, president, and Harvey L. Taylor, secretary and treasurer.

ERWIN, TENN.—The Southern Electric Light & Power Company has been incorporated by W. S. Erwin, W. T. Tucker, L. S. Tilson, J. F. Toney and E. N. Harrison, all of Erwin, and S. J. Kirkpatrick, of Jonesboro, Tenn. The company proposes to furnish electricity for lamps in Erwin, Unaka Springs and the United States Fishery; later on the company proposes to increase the capital stock and develop water power owned by J. F. Toney and S. J. Kirkpatrick.

HOWE, TEX.—The Howe Telephone Company has been incorporated with a capital stock of $2,500 by C. A. Shock, S. D. Donoho and R. S. Dougherty.

GROTON, VT.—The Groton Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of operating telephone lines in Groton, Bradford, Topsham, Bernet, Corinth, Newbury, Peacham and Ryegate.

MORGANTOWN, W. VA.—The Cheat River Electric Railway Company has applied to the Secretary of State for a charter to build an electric railway up Decker's Creek by the way of Dellslow to Cheat River and eventually to Point Marion, where it will connect with an electric road to be built from Fairchance. J. H. McDermott and H. R. Warfield are interested in the project.

BECKSTON, ONT., CAN.—The Beckston Rural Telephone Company has been incorporated, with a capital of $5,000. The incorporators are: A. J. Cumming, G. Bennett and W. Sloan, all of South Gower Township.

BOLTON, ONT., CAN.—The Bolton Telephone Company has been incorporated, with a capital of $20,000. The incorporators are: R. Smith, A. A. McFall and F. N. Leavens, all of Bolton.

MILESTONE, SASK., CAN.—The Milestone North East Telephone Company has been incorporated, with a capital of $5 000; also the Gary-Milestone Telephone Company, with a capital of $5,000.

Legal.

COMPANY LIABLE FOR INJURY BY UNINSULATED WIRE.—The owners of high-tension electric wires, located at places where people have the right to go for work, business or pleasure, must see to it that the insulation is made as perfect as is reasonably possible and exercise care to keep them in that condition; otherwise they may be held in damages for injuries resulting without negligence on the part of the person injured. This was held where it appeared that a smelting company maintained an insufficiently insulated wire, strung about 4 ft. above the roof of its building and carrying about 2500 volts. The plaintiff in the action was in the employ of the company at the time of the accident and had been sent out on the roof of the building to make certain repairs. The roof was in a wet and slippery condition, and the plaintiff, being a common laborer and ignorant of electrical knowledge, grasped the wire to keep from slipping and falling. It was held that in sending the employee on the roof the company was bound to anticipate that he might come in contact with them and should have provided against such an unfortunate contingency by having its wires in a properly insulated condition. Colusa Parrot Mining & Smelting Company vs. Monahan, United States Circuit Court of Appeals, 162 Fed., 276.

COMPANY LIABLE FOR DAMAGE WHERE IT HAS FAILED TO INSULATE.—A city owning an electric light plant, for reasons not stated, removed a guy wire supporting a trolley wire from the railroad company's pole and attached it to one of its own electric light poles. As originally constructed, the guy wires holding the trolley at this point were fastened to the company's own poles, and contained insulators preventing any escaping electric current from reaching the ground by way of the poles. Afterward the employees took down and again replaced the trolley, fastening the guy wire to the same pole. In one of these changes the insulator was removed. The city's lamp was supported by wires attached to this pole, and was so arranged that the trimmer could raise and lower the lamp by means of a flexible wire. The guy wire, by being fastened to the city's pole, was brought in direct contact with the wire the trimmer was obliged to handle in trimming the electric lamp, and he received the shock which caused his injury when he took hold of the flexible wire above mentioned for the purpose of lowering the lamp. It was contended in an action brought against the company by the trimmer that, since the city's employees first removed the wire from the company's pole to the pole of the city, there was no liability on the part of the company to answer for any injury done to an employee of the city by reason of such change. But such was held not to be the rule. The company owed to every one the duty of keeping its wires in a reasonable state of repair, and, if it discovered, or by reasonable diligence might have discovered, that this guy wire made the duties of the light trimmer hazardous or dangerous, it was its duty to correct the fault, and it was responsible for the neglect of that duty. Garretson v. Tacoma Railway & Power Company, Supreme Court of Washington, 96 Pac. 511.

ELECTRIC COMPANY NOT LIABLE FOR INJURIES TO TRESPASSING CHILDREN.—An electric light company placed its wires at a distance of about 20 ft. from the ground. Subsequently a telephone company ran its lines along the same street on poles 30 ft. high. At a point where the telephone line turned into a cross street two guy wires, one above the other, were fastened to the corner pole and attached to a log fixed in the ground. the upper guy wire passing within 8 in. of the electric light wire. The children of the neighborhood would hold on to the upper guy wire with their hands and walk on the lower wire, and then slide down, using the wires to play upon. One of them a little boy 11 years old, was playing upon the wires in this way, when his head touched the electric wire, thus completing the circuit, and he was instantly killed, and suit was brought against both the electric light company and the telephone company to recover for his death. A recovery was had in the Circuit Court for $1,000, but the decision was reversed on appeal, the Court saying: "As long as electric light wires are not put under ground, they must be put upon poles, and, where they are placed above the street as high as 18 ft., the company should not be required to anticipate that children will climb up to the wires and get hurt. Guy wires are necessary on high poles at street corners where the line turns. A guy wire placed on a high pole to keep it in place, or some such contrivance, cannot well be dispensed with. Such a wire is not a dangerous instrumentality, attractive or alluring to children within the meaning of the turntable cases. The little boy was a trespasser upon the defendant's wire, and, being a trespasser, he cannot complain that the premises were unsafe." The Courts have in a number of cases held electric light companies responsible where they permitted live wires to hang in the street. Thus, in City of Ownsboro v. York's Adm'r, 117 Ky. 294, 77 S. W. 1130, a little boy 12 years old discovered that a wire was hot, and, being dared by one of his companions to touch it, got on a board, took it in his hands and was killed. A judgment for the plaintiff was sustained. To same effect, see Macon v. Paducah Street Railway Co., 62 S. W. 496; Lexington Railroad Co. v. Fain's Adm'r, 71 S. W. 628; Thomas v. City of Somerset, 97 S. W. 420. But in all of these cases the wire was in the street. In the present case the wire was 18 feet above the street. It could only be reached by a person climbing the electric light pole or walking up the guy wire of the telephone company. In all the cases where a liability has been imposed for what is known as an attractive nuisance to children, the nuisance has been placed within their reach. No case is reported where this has been applied to things put 18 feet above the ground, which may only be reached by climbing a pole or walking up a wire. Such structures are not an invitation to children to use them. In Simonton v. Citizens' Electric Light Company, 28 Tex. Civ. App. 374, 67 S. W. 530, the defendant had placed spikes in its poles for the use of its men in ascending and descending them. Children in the neighborhood got to using the pole in the same way. One of them went up on the pole and lost his balance and fell to the ground. It was held that the company was not liable. The spikes on the side of the pole would offer a much greater inducement to a child to climb the pole than the guy wire offered in the case at hand. Mayfield Water & Light Company vs. Webb's Administrator, Court of Appeals of Kentucky, 111 S. W. Rep. 712.

Personals.

MR. IRVING W. PHILLIPS, of San Francisco, has joined the staff of the Ventanas Mining & Exploration Company, Ventenas, Durango, Mexico, where he is at present located.

MR. O. E. THOMAS, JR., of the General Electric Company, Schenectady, N. Y., has been transferred to the San Francisco office of the company and will travel over that territory as wire cable and wiring device specialist.

MR. J. A. J. SHULTZ.—At the last meeting of the Missouri Manufacturers' Association Mr. J. A. J. Shultz, president of the Shultz Belting Company, was elected president of the association. This is a Missouri state association, with headquarters in St. Louis.

MR. FRANK TRUMBULL, of the Trumbull Electric Manufacturing Company, Plainville, Conn., has just returned from an extended trip in South America. He speaks very enthusiastically in regard to the outlook in that continent for American materials of all kinds, especially electrical and agricultural equipment.

DR. J. CHANDRA BOSE, the distinguished professor of science at the University of Calcutta, India, is giving a series of lectures during the present month at the University of Illinois. Dr. Bose has published in the form of papers the result of a number of investigations into electrical phenomena and is the author of a work entitled "Comparative Electrophysiology."

MR. STANLEY H. HODGKIN, director of the well-known Pulsometer Engineering Company, Limited, Reading, England, is visiting this country, where his company has important business relations. A large number of the lamp exhausting pumps used here are of its make. The Pulsometer refrigeration equipment is in use on 60 ships in the British navy. Mr. Hodgkin will be here during a large part of this month.

MR. J. P. MALLETT, formerly chief engineer of the Northern Electrical Manufacturing Company, Madison, Wis., was the recipient on Sept. 30 of a handsome silver loving cup, presented by his associates in the works. The cup was inscribed as follows: "Presented to John Puritan Mallett on his retiring from the Northern Electrical Manufacturing Company, by his friends and fellow workers, as a token of their friendship and esteem."

MR. B. A. BEHREND has severed his connection with the Allis-Chalmers Company, after a service of five years as chief engineer of the electrical department, previous to which he had been chief engineer of the Bullock company for a similar period. Mr. David Hall, assistant chief engineer of the electrical department, and Mr. Allan B. Field, in charge of alternating-current work as assistant to Mr. Behrend, have also left the Allis-Chalmers Company.

DR. AUGUST RAPS, director of the telegraph and telephone department of the Siemens-Halske Company, Berlin, is again visiting this country to study the progress in telephony since he was here seven years ago. He is accompanied by three members of his technical staff, Messrs. George Grabe, Karl Baumann and Herman Heiser. The party will visit different parts of the country and will probably stay five or six weeks on this side, where Dr. Raps is well known.

CAPT. C. C. CARTER, U. S. M. A., 1899, has been detailed by the War Department to spend the current year at the Massachusetts Institute of Technology studying electrical engineering. Captain Carter is attached to the Coast Artillery Corps, and for the past few years has been an instructor in the Fortress Monroe Artillery School and the Fort Totten School of Submarine Defence. He has also served on the United States Artillery Board and the United States Torpedo Board. Captain Carter's course at Boston is undertaken as a preparation for giving more advanced instruction in electrical matters to the officers in the school at Fortress Monroe.

MR. HARRY PENNINGTON, Lumberman's National Bank Building, Houston, Tex., announces that he has been appointed Texas agent for the Wheeler Condenser & Engineering Company, of Carteret, N. J. Mr. Pennington has been engaged in the practice of mechanical engineering in Houston for a number of years and has been identified with many of the large enterprises in that section, having had charge during the past seven years of engineering construction work costing over $2,500,000. He is at present consulting engineer for the Galveston Water Works, engineer for Houston and Fort Bend counties, president of the Southwestern Engineers' and Architects' clubs and chief engineer officer of the State of Texas.

MR. LAWRENCE MANNING, of Camden, S. C., is opening an office as consulting engineer at Charlotte, N. C. After leaving the Virginia Polytechnic Institute, Mr. Manning went with the Camden Water, Light & Ice Company, Camden, S. C., and in the year 1900 he entered the testing department of the General Electric Company, at Schenectady. He went next into the drafting and contracting departments, leaving the company in 1904 to become general manager and purchasing agent of the Owosso (Mich.) & Corunna Electric Company, a lighting and railway property. In March, 1908, he became general superintendent of the Choctaw Railway & Lighting Company, at McAlester, Okla., resigning in September on account of ill-health, when he returned East.

Trade Publications.

GENERATING SETS of the self-contained, direct-connected type are well discussed in Bulletin No. 4617 of the General Electric Company, Schenectady, N. Y. These sets are rated at from 25 to 75 kw.

METALLIC PACKING.—The C. Lee Manufacturing Company, Louisville, Ky., has issued a booklet devoted to metallic packing for steam, gas and air engines. A long list of satisfied users is included.

TRUMBULL BULLETIN.—The October bulletin of the Trumbull Electric Manufacturing Company, Plainsville, Conn., contains late information relative to Trumbull switches, switchboards, etc. In addition, there is a lot of the usual bright talk.

MOTOR DRIVES.—Bulletin No. 1111 of the Fort Wayne Electric Works is a neatly illustrated 24-page publication illustrating and describing electric motor drives as applied to machine tools. Both direct-current and alternating-current motors are discussed.

SWITCHES.—The Worcester Electric Manufacturing Company, Worcester, Mass., has issued as Catalogue No. 8 a 66-page publication illustrating, describing and listing knife switches, switchboards, panel-boards, fuse-blocks for all circuits using direct or alternating current.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing an attractive circular devoted to its new "Guaranteed" electric flat iron, calling special attention to the fact that the iron is actually guaranteed. Considerable detailed information is given as to the mechanical and electrical design pertinent to the subject.

THE BAY STATE COMPANY.—We are informed by the Bay State Insulated Wire & Cable Company, of Hyde Park, Mass., that it is no longer connected in any way with the Western Wire Sales Company, of Chicago, which there ceases to act as its agent. Hereafter Mr. Richard Wick, of 356 Dearborn Street, Chicago, will represent it in Chicago.

RECORDING METERS.—A new flyer issued by the Central Electric Company, Chicago, Ill., describes a complete line of recording voltmeters, ammeters and wattmeters of both the series and shunt types. The portable types are furnished in compact wooden cases, permitting of easy handling and transportation. Copies of a circular on the subject will be sent upon request.

MANUAL FOR ENGINEERS.—The American Blower Company, of Detroit, Mich., has on hand a limited number of the manual for engineers, compiled by Prof. C. E. Ferris, of the University of Tennessee. It is leather covered, vest pocket size. Any engineer or contractor wishing to secure a copy, and applying promptly, will be supplied as long as the copies last.

TUNGSTEN LAMP BULLETIN.—The Franklin Electric Manufacturing Company, Hartford, Conn., has issued Bulletin No. 7, which is devoted entirely to tungsten lamps. The bulletin contains eight pages full of interesting facts about tungsten lamps, besides many attractive illustrations. A price list is also given.

LINE MATERIAL.—The Pettingell-Andrews Company, of Boston, Mass., has issued a new catalog illustrating a line of malleable-iron specialties, consisting of insulator pins, cross-arm bolts, catenary hangers, pole anchors, re-enforcing sleeves, corner brackets, etc. Embodied in the catalog is the report made by the testing laboratories of Columbia University, showing the results of an exhaustive test on cross-arm bolts.

ELEVATORS.—The *Indicator*, published by the Otis Elevator Company, New York, is a neat periodical publication designed to diffuse among the co-workers of the company information regarding the progress and development of the industry and to familiarize them with the improvements that are being made in the apparatus and with the better methods being employed.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing several publications on Columbia tungsten and Columbia tantalum filament lamps, calling attention to the fact that Columbia lamps have been on the market for some 19 years. Accompanying the publications is a considerable amount of data, showing the watt consumption of the various lamps.

THE LORD ELECTRIC COMPANY, New York, is bringing out some very interesting lines of electrical appliances, among which is the "Hydro-Ground." This is stated to be entirely different from anything that has ever thus far been employed to secure satisfactory grounding for lightning arresters, transformers, etc. It is not subject to electrolysis, attracts and retains moisture and offers a large surface of low resistance.

RECORDING INSTRUMENTS, including ammeters, voltmeters and wattmeters for alternating-current and direct-current circuits in both portable and switchboard patterns, are listed and described in Pamphlet D. 20 of John Bliss & Co., 128 Front St., New York. The recording wattmeters are wattmeters of the true recording type, and are not to be confused with watt-hour meters, sometimes erroneously called "recording wattmeters."

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing new circulars on special flush type group switches and receptacles of the Perkins type. The circular also describes some new designs of pendant switches with both bottom and side release. A new shallow type of "Universal" push button switch for use in all standard devices is described, for which many advantages are claimed. Copy of these publications will be forwarded upon request.

PAPER MILL PLANT.—The system planned for the new mill of the Watab Pulp & Paper Company, near St. Cloud, Minn., affords a striking example of minimized transmission losses. A complete description of the equipment, consisting mostly of induction motors ranging from 5 to 100 hp, is given in an article reprinted by Allis-Chalmers Company. The plant has now been in continuous operation for some time. It began making paper a few hours after current was first turned on, and has not been shut down since by any failure of equipment.

HOTEL AND STORE EQUIPMENT.—The Western Electric Company, New York and Chicago, does an immense amount of installation work in hotels and department stores, and has just issued two very interesting bulletins on these respective subjects. Some of the best known hotels and stores in the country are included in the treatment of the subject, and descriptive and illustrative data are given as to the various classes of apparatus required and used in such installations, including generators, motors, acr lamps, intercommunicating telephones, etc.

STEAM ENGINE AUXILIARIES.—The Wheeler Condenser & Engineering Company, of Carteret, N. J., is distributing a 16-page bulletin, No. 101, which outlines this company's facilities and products, including Admiralty surface condensers, jet and barometric condensers, Edwards patent air pump, Volz combined condenser and feed water heaters, feed water heaters, improved reheaters and receivers, vertical engines, centrifugal pumps, rotative dry vacuum pumps, Barnard water cooling towers, vacuum fans and multiple effects for sugar and chemical works, etc.

NEW INSTRUMENTS.—The Central Laboratory Supply Company, La Fayette, Ind., has placed on the market an instrument which consists of an edgewise indicating instrument and a graphic curve drawing instrument in one. These instruments are made for both alternating and direct currents, and in the form of ammeters, voltmeters and wattmeters, and totalizing meters, the latter being an instrument which combines the outputs of all the generators in a plant, drawing the load curve of the entire plant on a single chart. These instruments are fully described in Bulletin 125, which will be sent upon request.

TRUMBULL.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has issued an interesting number of its *Trumbull Cheer* for September. It illustrates and describes the new flush receptacles, with elongated car, the wires entering outside instead of through the porcelain. A view is also shown of the show window of the Altoona, Pa., Electrical Engineering Supply Company, filled decoratively with their Circlet material. A view is also given of a starting rheostat slate, with switch. Incidentally, a good deal of fitting philosophy is thrown in on life and things in general, and there is a home-made poem on the conversion of an electrical engineer.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has just issued "Hand Book IP," which is a publication of special interest to dealers and contractors. It treats of the application of the chloride

accumulator to small isolated electric lighting and power plants for factories, residences, etc., where electric service from central stations is not available. It shows how the advantages of a 24-hour electric service are made possible by the use of a battery of chloride accumulators, entering fully into the subject and giving illustrations of the types of batteries and switchboards required for installations of different capacities. Specifications and prices for complete installations are given.

HIGH VOLTAGE TRANSFORMERS.—Bulletin No. 4616, recently issued by the General Electric Company, contains a detailed description of the company's high voltage Type H transformers, used in connection with long distance transmission lines, and designed for indoor operation. Where conditions require the use of the outdoor type, however, the General Electric Company will make special quotations upon request. This transformer is similar in construction to the transformer for moderate voltage. It is oil insulated, self cooled, and the larger sizes of these transformers are water cooled. It is made in sizes up to approximately 350 kw capacity for operation on circuits of the highest commercial voltage.

"BOILER TROUBLES AND THEIR PREVENTION" is the title of a 48-page treatise just issued by the Bird-Archer Company. This book will interest all who own or operate steam boilers, for it explains corrosion, scale, oil and grease deposits and what harm they may do. It tells what scale consists of, how it collects, resulting loss in fuel and steaming capacity, dangers from overheating, cost of mechanical cleaning and the advantage of boiler compounds in preventing scale, oil deposit or corrosion. It further discusses every method of water and scale treatment, gives valuable advice on feeding boiler compounds, the care of blow-off valves, etc. Copies may be had free by addressing the Bird-Archer Company, 90 West Street, New York.

THE MULTI-CATCH SOCKET.—The General Electric Company, of Schenectady, N. Y., has just issued an attractive booklet descriptive of its "Multi-catch Socket," primarily intended for fixture work, although it may be used wherever the standard socket is used. The appearance of this socket is practically the same as that of the standard type. The great advantage lies in the facility with which it can be attached to a fixture containing a husk. No screw driver is needed, the shell being snapped in place and held rigidly at four points. This socket contains also the new General Electric center contact, the advantages of which, together with the chief characteristics of the socket, are described and illustrated in booklet No. 3700.

BELT DRIVEN ALTERNATORS.—In Bulletin No. 4618, just issued by the General Electric Company, Schenectady, N. Y., there is described the company's new Form P B polyphase generator for use in small power plants and isolated lighting plants where rapidly increasing inductive loads, and consequently low power factors, are encountered. Although usually furnished as belt driven generators, these generators are readily adapted for direct connection to water wheels, by omitting the driving pulley and sub-base and adding a coupling. The generators are separately excited, and are simply and substantially constructed. They are designed for 240, 480, 600, 1150 and 2300 volts. The bulletin contains a full description, with weights and dimensions.

THOMSON DIRECT-CURRENT TEST METER.—Precision in meters measuring power delivered by central stations to consumers is of vital importance to the central station as well as to the consumer. While the customary method of making such tests would answer where the tests are few in number, the rapid increase in the use of electricity for both lighting and power purposes demands a method whereby tests can be made more quickly, but with the same degree of reliability. For this purpose, the test meter manufactured by the General Electric Company, Schenectady, N. Y., was designed, and is described and illustrated in Bulletin No. 4615, just issued. This meter is inclosed in a wooden carrying case, and is furnished in two distinct ampere ratings: 1, 2, 10, 20, 40 amp, or 5, 10, 50, 100 amp, each with single 110 volt, or double 100/220 volt potential windings. A diagram of connections accompanies the meter and shows the proper method of connecting the meter in the circuit. The prices of this meter are quoted in the bulletin.

Business Notes.

THE DODGE COAL STORAGE COMPANY has changed its corporate name to the J. M. Dodge Company. James M. Dodge, chairman of the Link-Belt Company, is president.

THE MASSACHUSETTS CHEMICAL COMPANY announces that it has moved its New York office from 237 Broadway to the Hudson Terminal Building, 30 Church Street. Mr. A. G. Cozzens is sales agent, as formerly. At the new address the well-known line of electrical tapes, insulating fabrics and compounds and molded rubber goods will be carried to fill emergency orders. The former telephone number, 3440 Cortlandt, is retained.

HARVARD ELECTRIC COMPANY.—Mr. Allen L. Hasse, long connected with the electrical bracket trade in Chicago, has resigned as sales manager for Peirce brackets, with which he has been identified for many years. He has made a contract with the Harvard Electric Company, of 66 W. Van Buren Street, Chicago, and 136 Liberty Street, New York, as general sales manager. He will give special attention to developing the Harvard patent steel bracket and other Harvard exclusive construction specialties.

THE U. T. HUNGERFORD BRASS & COPPER COMPANY is making a special quality of brass for drawing and spinning purposes. In the manufacture of electrical appliances there is frequent demand for articles made from sheet brass that necessitates deep drawing or spinning. For articles of this kind it is advisable to use only the best quality of brass, as it frequently happens when an inferior grade is used that the metal will fail before the last operation, and all the labor on previous operations is lost.

THE GORKE STORE.—Mr. H. J. Gorke, electrical machinery and supplies, 216 W. Washington Street, Syracuse, N. Y., reports that the business is increasing its store capacity, taking on another building next to that which it has been occupying for nearly 10 years. This gives Mr. Gorke a floor space of nearly 7000 sq. ft. The fact above noted is cheerful news in dull times.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 6, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

900,165. PROGRESSIVE CUT-OUT MECHANISM; Jay H. Hall, New York, N. Y. App. filed March 18, 1908. Includes an electric motor having a starting switch and a cut-out switch, means for driving the movable member to successive cut-out positions, and a means for rendering the said cut-out driving means inoperative for a predetermined travel of the driven mechanism for each cut-out operation.

900,169. APPARATUS FOR ELECTROPLATING METAL SHEETS; Henry L. Hollis, Chicago, Ill. App. filed Aug. 1, 1907. Has a plurality of vertical rotatable rollers associated with driving mechanism so disposed with relation to each other as to convey the sheets through the bath when motion is imparted thereto, the rollers being spaced so that one set engages the sheet before the preceding set releases it, and in this way securing a continuous movement of the sheet through the bath.

900,192. ELECTRIC FURNACE; Robert McKnight, Pittsburg, Pa. App. filed Aug. 28, 1906. A revolving furnace has an electrically heated fire-box at one end, a series of ore outlet ports situated along the said revolving furnace, and means for closing said ports.

900,207. ELECTRIC FURNACE; J. H. Reid, Cornwall, Ont., Can. App. filed April 1, 1907. Relates to electric furnace in which the ore drops by gravity in a fine stream downward past a series of convergent electrodes.

900,208. ELECTRIC LAUNDRY IRON; Earl H. Richardson, Ontario, Cal. App. filed Dec. 2, 1907. The iron includes a pair of spirally wound resistance elements arranged at an angle to one another and including a thermic fuse adapted to cut off the current when a certain temperature is attained.

900,238. TELEGRAPH KEY; James Z. Tucker and Lawrence V. Tucker, St. Louis, Mo. App. filed Dec. 16, 1907. Patentee has a circuit-closing lever on the telegraph key, spring impelled into circuit-closing relation, and is constantly in position to open the circuit by the hand of the operator during the transmission of signals.

900,265. SUPPORTING MECHANISM; George Cutter, Winnetka, Ill. App. filed Sept. 10, 1904. A hoisting apparatus for arc lamps of the type in which the lamp is locked in its elevated position, or lowered, by manipulation of an operating cord through successive pulls thereon.

900,278. ELECTROLYTIC ALTERNATING-CURRENT RECTIFIER; Arthur S. Hickley, Manasquan, N. J. App. filed Nov. 12, 1907. An electrolytic alternating-current rectifier having insulating members extending into the electrolyte and above the cell for protecting the terminals against short circuiting.

900,279. ELECTROLYTIC ALTERNATING-CURRENT RECTIFIER; Arthur S. Hickley, Manasquan, N. J. App. filed Jan. 16, 1908. An electrolytic cell for alternating-current rectifiers having an active electrode extending across the cell near the bottom and through one wall thereof.

900,289. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Benjamin G. Lamme, Pittsburg, Pa. App. filed Dec. 4, 1905. The combination with an electric motor that may be operated by either alternating or direct currents, of an auxiliary field magnet winding therefor that remains open circuited when the motor is operated by alternating currents, but which is closed circuited on itself when the motor is operated by direct currents.

900,292. ELECTRIC CURLING-IRON HEATER; Wynn Meredith, San Francisco, Cal. App. filed Sept. 25, 1907. A small cylindrical heater adapted to screw in an ordinary lamp socket. The resistance wire is wound on a thin mica tube and is surrounded by a heavy heat insulating cover whereby substantially all the heat is passed into the curling iron.

900,295. ELECTRIC HEATING DEVICE; William C. Mortensen, Salt Lake City, Utah. App. filed April 6, 1908. An urn for maintaining beverages continuously warm. Includes a plurality of incandescent lamps as heating elements within the body of the receptacle.

900,298. RAIL BOND. Archie W. McConnell, Anderson, S. C. App. filed Aug. 4, 1908. Has a bond and a plate positioned between said bond and the rail joint, and a casing disposed about said bond.

900,320. CIRCUIT INTERRUPTER; Cullen B. Snell, Bradford, Mass. App. filed Feb. 18, 1907. A circuit operating device comprising an

electromagnet having a vibrating armature and means for yieldingly supporting said operating device.

900,340. APPARATUS FOR ELECTROPLATING; John A. Yunck, South Orange, N. J. App. filed Nov. 8, 1906. A means for copper plating the silvered portion of an incandescent lamp bulb to form an effective reflector. Includes a specially constructed anode, whereby the deposit of the copper film does not disturb the silver film.

900,359. CHANGING BATTERIES IN ELECTRICALLY PROPELLED VEHICLES; Albert J. Doty, Mount Vernon, N. Y. App. filed Feb. 3, 1908. A mechanism for expeditiously changing the batteries in a power truck or wagon. Includes a pair of battery trucks on opposite sides of the vehicle in position to supply a fresh battery at one side at the same time that the exhausted battery is removed from the other side.

900,360. BLOCK-SIGNALING DEVICE; William Fechner and Albert Henry Fechner, Goliad, Tex. App. filed July 23, 1907. A trolley mounted on a locomotive and designed to be swung from one side to the other by mechanism mounted within the cab, so that the trolley may at all times be in proper position for engaging signal-carrying wires positioned at one side of the track.

900,372. ANTISEPTIC MOUTHPIECE FOR TELEPHONES, SPEAKING TUBES, ETC.; Milton S. Hufschmidt, San Francisco, Cal. App. filed April 7, 1906. A mouthpiece comprising a hollow body, a porous disk extending transversely across the interior of the same, and a perforated metallic plate located over said disk.

900,382. MOISTURE-PROOF CASE FOR INSULATED WIRES; Adrian L. Joynes, Paducah, Ky. App. filed June 4, 1906. Relates to moisture-proof outlet cases for covering parts of cables of electrical conducting wires where the lead armor has been removed or is absent, so that the wires are exposed.

900,386. TELEPHONE TRANSMITTER; Adolph G. Kaufman and Leopold J. Lippmann, New York, N. Y. App. filed Jan. 19, 1907. A telephone transmitter comprising a casing, a diaphragm, a conducting carrier facing the diaphragm, loose conducting material between the carrier and the diaphragm, and ball-shaped contact members projecting into said loose conducting material.

900,387. TELEPHONE RECEIVER; Adolph G. Kaufman and Leopold J. Lippmann, New York, N. Y. App. filed Feb. 7, 1907. A telephone receiver comprising a casing, a magnet supported therein, magnetic coils, a diaphragm box carried by the magnet directly and independently of the casing, and a diaphragm in said box.

900,404. TELEPHONE DESK SET; Ray H. Manson, Elyria, Ohio. App. filed Aug. 23, 1907. In a telephone desk set, a standard comprising a stamped and formed base and upright in one piece, a stamped and formed cap and hinge member in one piece, and means within the upright for securing the hinge member to the base.

900,416. ELECTRIC GLOW LAMP; Walther Nernst, Gottingen, Germany. App. filed March 29, 1908. An improved glower for electrical incandescent lamps which is a non-conductor when cold, but which becomes a good conductor and incandescent under the action of an electric current at high temperatures, and which consists essentially of a mixture of refractory metallic oxids.

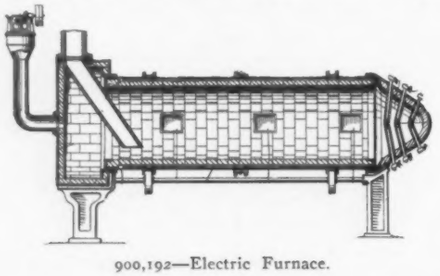
900,420. VARIABLE-SPEED MOTOR; Alvin A. Pifer and Charles E. F. Ahlm, Cleveland, Ohio. App. filed Feb. 14, 1906. A regulator for dynamo-electric machinery comprising two separate pole-shoe sections adapted to be moved toward and from each other, the center of each section moving substantially in the plane passing through the axes of the pole pieces of the machine.

900,429. ELECTROSONATOR; Ryusai Sakamoto, Tokyo, Japan. App. filed April 11, 1907. A device for producing sound of a certain character and adapted to be applied to the body of a patient in such a way that a medical practitioner listening with a stethoscope may locate organs beneath the skin.

900,435. SELF-RESTORING DROP RELAY; Frank M. Slough, Elyria, Ohio. App. filed May 29, 1907. Self-restoring drop relays for use in toll line circuits or for private branch exchange trunk circuits.

900,447. ANTISEPTIC ATTACHMENT FOR TELEPHONES; Frank C. Tabler, St. Louis, Mo. App. filed Jan. 24, 1908. An antiseptic attachment for telephones, comprising fibrous material arranged in front of, and parallel to, the diaphragm of a telephone, and means for supplying said fibrous material with an antiseptic medium.

900,456. BLOCK-SIGNAL SYSTEM FOR RAILWAYS; James T. West, Rockingham, N. C. A block-signal system having a track



900,192—Electric Furnace.

divided into block sections and locomotives provided with signal devices which are connected in circuits with the block sections of the track, the signal devices on one locomotive or vehicle being set according to the movements of another locomotive or vehicle which may be moving either in the same or in an opposite direction.

900,458. TELEPHONE TESTING SYSTEM FOR PARTY LINES; Charles S. Winston, Chicago, Ill. App. filed May 31, 1905. In a testing system, the combination with a telephone line having a busy testing terminal, of an operator's testing contact for testing the busy condition of the line, a testing circuit including a portion of the talking circuit of the answering end of the cord adapted to be closed when a busy line is tested, and means associated with said circuit for interrupting the current flow therein, whereby when said circuit is closed a special tone is produced in the operator's receiver.

900,476. COVER FOR ELECTRIC BATTERIES; Horatio J. Brewer, New York, N. Y. App. filed May 29, 1908. A means to effect the inclination of the positive zinc rod electrode with relation to and away from the negative electrode for the purpose of guarding against contact between the electrodes when in their normal positions.

900,478. ALTERNATING-CURRENT MOTOR; James H. Bryson, St. Louis, Mo. App. filed Oct. 7, 1907. A means for reversing the direction of rotation of motors, and more particularly single-phase motors of the self-starting variety in which one or more of the members is provided with a winding, the currents in which are commuted at starting to produce definite armature magnetic poles.

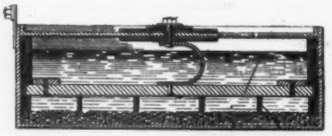
900,486. ELECTRIC FURNACE; Erik Cornelius, Trolhättan, Sweden. App. filed July 9, 1908. An electric furnace comprising an annular chamber having a fixed electrode in and coextensive with the bottom of said chamber and a movable electrode arranged to travel along the top of the chamber.

900,488. RAIL BOND; Fred H. Daniels and Charles R. Sturtevant, Worcester, Mass. App. filed Dec. 1, 1906. The rail has a hole at its bottom in which the terminal of the bond is received, the latter being expanded therein by a pin.

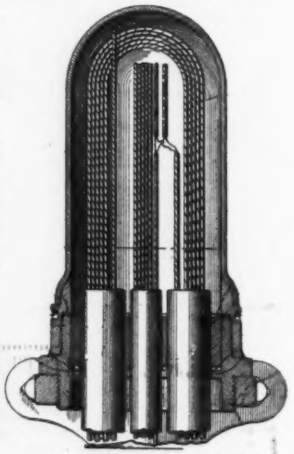
900,489. TELEPHONE-EXCHANGE SYSTEM; William W. Dean, Elyria, Ohio. App. filed Oct. 18, 1906. In a telephone-exchange system, an operator's cord circuit and calling plug, a ringing relay adapted to connect the generator to line and a static relay controlling the ringing relay.

900,493. APPLIANCE FOR THE CURE OF RHEUMATISM AND OTHER DISEASES; Daniel Rudd Dewey, Hamilton, Ont. App. filed Dec. 26, 1907. A device for curing rheumatism, etc., comprising a jar which contains an electric glow lamp and has an opaque cover with a series of slots through which the light may be emitted. Is intended to supply a certain warmth and a limited amount of heat and light rays.

960,502. ELECTRODE FOR ELECTROLYTIC PURPOSES; Paul Ferchland, Berlin, and Joseph Nussbaum, Charlottenburg, Germany. App. filed Nov. 5, 1906. A substitute for platinum in an electrolytic process. Consists in dropping a conductor into a lead salt and subjecting it to an electric current.



900,571—Secondary Battery.



900,382—Moisture Proof Case for Insulated Wires.

900,553. TELEGRAPHIC RELAY; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 14, 1908. Has two series of selenium cells, and electromagnetic means for each of said series to place in the circuit a selenium cell of normal resistance after the lowering of the resistance of a neighboring cell.

900,555. CONTROLLING SYSTEM FOR ELECTRIC MOTORS; Benjamin G. Lamme, Pittsburg, Pa. App. filed Feb. 24, 1908. The combination with a source of direct currents, a source of alternating currents, a plurality of electric motors adapted to be operated by either character of energy and provided with auxiliary field magnet windings connected in closed circuit, of means for arranging the circuit relations of the motors in accordance with the character of energy supplied thereto and so that induced currents in the respective auxiliary field magnet windings may traverse the closed circuit in the same direction when operating by direct currents and in opposite directions when operating by alternating currents.

900,571. SECONDARY BATTERY; William Morrison, Chicago, Ill. App. filed June 8, 1903. An insulator adapted to insulate the sides of the cell from the solution and from the negative electrode.

900,597. PROCESS FOR PRODUCING AN ELECTROLYTIC DEPOSIT OF METALLIC CHROMIUM; Franz Salzer, Dresden, Germany. App. filed Jan. 16, 1908. The process for producing an electrolytic deposit of metallic chromium by employing a bath containing a mixture of chromic acid and chromoxid.

900,612. CONTROLLER; Emmett W. Stull, Norwood, Ohio. App. filed Feb. 15, 1908. The combination of a plurality of series-parallel controlling drums, a drum-type switch for connecting said first-mentioned drums either in series or in parallel, and a drum-type reversing switch.

900,613. AUTOMATIC CIRCUIT CLOSER FOR ELECTRIC-LAMP HOLDERS; William D. Tickner and Lucius C. Tickner, Blanchardville, Wis. App. filed Feb. 3, 1908. A holder for an electric lamp provided with means for automatically closing the circuit to the lamp when the weight of the lamp is removed from the holder, and conversely the said circuit is opened when the lamp is placed upon the holder.

900,641. ELECTRIC FIRE ALARM; Harry Anderson, Haddonfield, N. J. App. filed Feb. 14, 1908. An alarm having normally separated contact members which are normally separated by a fusable block and spring impelled together when the fusable block melts.

900,658. REMOTE-CONTROL ELECTRIC SWITCH; Jay S. Bristol, Gillespie, Ill. App. filed April 6, 1907. Employs a main switch for cutting a supply circuit into and out of connection with the source of supply, solenoids arranged to open and close the main switch, the circuits of the solenoid being alternately changed by an automatic switch or circuit changer intermediate the solenoids and power house.

900,676. TELEPHONE-EXCHANGE SYSTEM; Ray H. Manson, Elyria, Ohio. App. filed May 29, 1907. In a harmonic signaling system, means for supplying a plurality of currents at different frequencies, means for connecting the same to a wanted subscriber's line, and controlling means therefor, with an equalizing shunt for said controlling means.

900,679. SIGNAL APPARATUS; Walter T. Moon, Baltimore, Md. App. filed Jan. 5, 1905. A signal system for an apartment house in place of the present simple call bell system.

Reissue 12,860. CONDENSER AND PROCESS OF MAKING SAME; Maurice K. McGrath, of Antwerp, Belgium. App. filed April 6, 1907. A condenser in the form of a rectangular prism, composed of a folded roll of conducting and insulating strips subjected to pressure upon all sides of said prism.